

THE FRENA.

64

THE
F R E N A
HANDBOOK.

LONDON :
R. & J. BECK,
68, CORNHILL, E.C.
1892.

My ingenious instrument !

Cymbeline, iv. 2.

Introduction.

HALF a century has now elapsed since the first steps were taken in the art of photography. Until recent years it was an art the practice of which was neither attractive nor readily acquired. The preparation of the plates necessarily devolved upon the operator, who, carrying his dark-room and chemicals about with him wherever he went, had to develop each negative while the glass was still dripping from the sensitizing bath. As the time of exposure was long, objects in motion could not be taken. So exceedingly complicated and tedious were the technical processes involved in finishing a picture, that the practice of out-door photography by an amateur was almost unheard of.

When, however, the so-called gelatine, or dry plate process, superseded the collodion, or wet process, the art was not only increased in capabilities, but was most widely extended. A new branch of manufacture has arisen, supplying us with plates ready for use, which retain their sensitive qualities for months and even years. Above all, we have now a photographic film of a nature so sensitive that an instantaneous flash of sunlight suffices to give a perfect photographic image.

Delighted with the facility and rapidity of modern photographic processes, a constantly increasing number of amateurs devote themselves to this pursuit. And with good reason, for no recreative study better repays its devotees.

Keeping pace with the demand thus created, there have been published a large number of manuals written for the purpose of instructing beginners in the art of photography. We may refer the student, among many others, to Burton, W. M., *Modern Photography*, London (Piper & Carter); Jones, Chapman, *Introduction to the Science and Practice of Photography*, London (Iliffe & Son);

Hepworth, T. C., *Photography for Amateurs*, London (Cassell & Co.); Abney, Captain W. de W., *Instruction in Photography*, London (Piper & Carter); by the same author, *A Treatise on Photography*, London (Longmans, Green & Co.); Brothers, A., *Photography, its History, Processes, Apparatus and Materials*, Philadelphia (Lippincott); Vieuille, G., *Guide Pratique du Photographe Amateur*, Paris (Gauthier-Villars); Vidal L., *Manuel du Touriste Photographe*, Paris (Gauthier-Villars); Klary, C., *Guide de l'Amateur Photographe*, Paris (Marpon & Flammarion); Pizzighelli, Major G., *Anleitung zur Photographie für Anfänger*, Halle (Knapp); and by the same author, on a somewhat larger scale, in three volumes, *Handbuch der Photographie für Amateure und Touristen*, Halle (Knapp); Liesegang, E., *Handbuch des praktischen Photographen*, Düsseldorf (Liesegang); Schmidt, F., *Compendium der praktischen Photographie*, Karlsruhe (Nennich); Gioppi, L., *La Fotografia secondo i processi moderni*, Milano (Hoepli). The most complete works on the subject, in any language, are undoubtedly two books having identically the same title, viz., *Ausführliches Handbuch der Photographie*; the one by Dr. Eder, being published, in fourth edition, at Halle, 1890-91 (Knapp); the other by Dr. Vogel, being published, likewise in fourth edition, at Berlin, 1890-91 (Oppenheim). Of these two rivals, we give our decided preference to the former.

From such books, as well as from the extensive periodical literature devoted to the subject, the student of Photography may gather full information concerning the principles of photographic optics, the reactions of photographic chemicals, the various and variable factors which govern the length of exposure, and, in particular, the means of producing the negative by development, and of reproducing it by the diverse methods of photographic printing. There is, however, one important topic, which is, unavoidably, treated but superficially in these works: they convey to the photographer little or no information directly applicable to the capabilities and the manipulation of the particular camera with which he may provide himself.

Our present purpose is to supply special information relative to the apparatus known as the Frena. Such a contribution to the literature of photographic manipulation is in this case the more necessary, as the Frena is the first and only hand camera made for the purpose of exposing a pack of films in single sheets, without the intervention of double backs, roll-holders or carriers of any kind whatsoever.

In a general way it may be said that the following pages have been written with a view

of facilitating and improving the quality of amateur work by the methods of restriction and simplification. The Frenographer will photograph upon films exclusively, instead of upon glass. He will limit himself to hand camera work. Thus freed from the perplexities which arise from a multiplicity of methods, the amateur will, we trust, make the most rapid possible progress towards technical excellence.

More than this. The simplicity of the Frena system is such that pictures of the finest quality may be taken by those who know nothing whatever about photographic processes, and have no desire to trouble themselves therewith. Three manipulations, repeated for each exposure, are all that is required of the operator. These manipulations are :

1. **Wind the shutter.**
2. **Make the Exposure by setting off the shutter.**
3. **Change the Film by turning the handle.**

Anyone who can ring an electric bell and turn a key can take pictures with the apparatus which we place in his hands. When the forty photographs which form the first charge have been taken, the entire camera can, if desired, be sent to us unopened. We remove the photographic films, develop and print them, supply the pictures in any desired number, and return the apparatus recharged and ready for further exposures. This is photography in its simplest conceivable form.

If the operator be provided with a photographic dark-room lamp, he can, at night time, in any well-closed room, remove the exposed films from the receiving chamber of the Frena in the manner set forth in Section 9 of this little book. He can then wrap the pack of exposed films in tissue paper, enclose them in the set of envelopes supplied for the purpose, and, after securely sealing the outer one, forward them to us by letter-post. By adopting this course, the Frenographer will not be deprived of the use of his camera at all. Full directions for packing and forwarding are given in Section 10.

Thus, *picture-taking* does not necessarily involve *picture-making*, and the practice of this delightful and instructive art is possible for thousands who might not otherwise have the time or the patience to master any of its technical details.

We have a department devoted exclusively to the development and printing of Frena negatives. The most experienced and skilful operators are employed in this work. It is obviously our interest to obtain the best possible results from every negative entrusted to our care.

Let it be understood, however, that we strongly recommend every amateur to do his own developing. A great part of the interest and instructiveness of photography is dependent upon this practice, and a perfect knowledge in respect to the choice and illumination of the subjects, and the length of the exposure, can only be obtained when the operator carries out all the subsequent processes.

In conclusion, we would lay stress upon the fact that the Frena possesses features which enable it to be used for making pictures such as have, until the present date, been impossible with any form of hand camera; the swing back and level,

for instance, which provide the only known means for taking photographs in correct perspective when the apparatus is pointed slightly up or down, has hitherto only been found in the more complicated and expensive forms of tripod cameras.

In order that the operator may be enabled to take advantage of all the capabilities of the apparatus, we offer him herewith, together with a concise description of the necessary manipulations, an extensive series of notes on the use of the Frena, grouped under the following heads:—

Outline of Operations	PAGE 17
1. On the choice of the View and its composition in the Finder	33
2. On the Illumination of the Subject	46
3. On the Duration of the Exposure	50
4. On Winding and Setting the Shutter	63
5. On holding the Frena and making the Exposure ..	70

6. On the use of the Swing Back and Level	76
7. On changing the Film	83
8. On reading and setting the Indicator	86
9. On removing exposed Films and recharging	90
10. On packing and forwarding the Frena and Frena Films	112
11. On Time Exposures and In- teriors	115
12. On the Development of Films with Frenol	121
13. On Development as a criterion of Exposure	139
14. On Printing with Chloride Paper	144
Index	157

The novice who desires to take pictures in the simplest possible way, should, after reading the Outline of Operations, turn at once to the paragraphs printed in large type which will be found in Section 4, on Winding and Setting the Shutter; in Section 5,

on Holding the Frena and Making the Exposure; and in Section 7 on Changing the Film. In his first attempts he need not avail himself of all the capabilities of the Frena. He should not, for instance, undertake time exposures, nor use the swing back.

On the other hand, let not the photographic operator of experience take umbrage at the axiomatic and apparently unnecessary character of certain passages in this little book. Incredible as it may appear to the expert, it is an everyday occurrence for beginners in hand camera work to attempt a long series of exposures with a cover-plate or felt plug obscuring the lens aperture,—or, worse still, to occasionally open the camera itself, in broad daylight, in order to ascertain that all is going on well inside. Therefore bear in mind, charitable expert, that what may be useless, if not actually offensive to you, may be a point of fundamental importance to another.

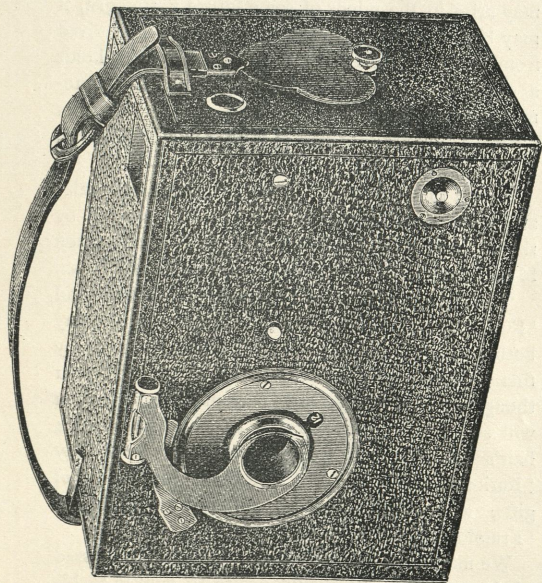


FIG. 1. THE FRENA.—ONE-THIRD ACTUAL SIZE.

ETYMOLOGICAL NOTE.

With a view to removing any uncertainty which may arise in the minds of some future philologist, it may be remarked that the word **Frena** is derived from FARO (a game played with a box which holds a pack of cards, and, without being opened, automatically discharges one after the other), and from CRENA, a *notch* (the root of such words as Crenate, Crenel, &c.)

Should the etymologist object to this as an irregular and agglutinative derivation, he may be answered by the classical exemplification of Carroll's Law given in the preface to "*The Hunting of the Snark*":—

"For instance, take the two words 'Fuming' and 'Furious.' Make up your mind that you will say both words, but leave it unsettled which you will say first. Now open your mouth and speak. If your thoughts incline ever so little towards 'Fuming,' you will say 'Fuming-Furious;' if they turn, by even a hair's breadth, towards 'Furious,' you will say 'Furious-Fuming;' but if you have that rarest of gifts, a perfectly balanced mind, you will say 'Frumious.'"

We may hence safely conclude that if one possessed of this rarest of gifts should desire to convey to his fellow-man the conception of an apparatus which automatically discharges one film after another, like a *faro box*, and does this by means of *notches*, he would immediately exclaim "**Frena!**"

The • Arena.

Outline • of • Operations.

*N.B.—A more detailed description of these processes
will be found on the pages indicated.*

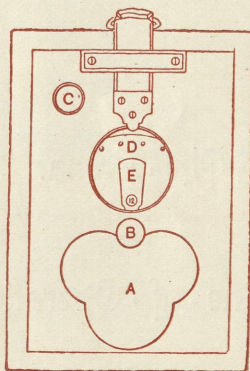


FIG. 2.—THE FRENA.

Front View.

- A.—Cover-Plate.
- B.—Shutter Knob.
- C.—Finder Lens.
- D.—Shutter Time-Plate.
- E.—Shutter Time-Catch.

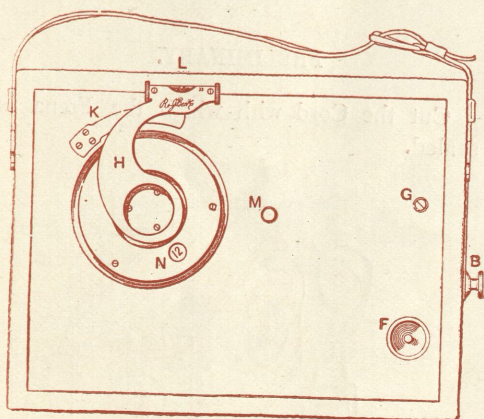


FIG. 3.—THE FRENA.

View of Right-hand Side.

- B.—Shutter Knob.
- F.—Shutter Set-off.
- G.—Shutter Time-Rod.
- H.—Handle.
- K.—Register Spring.
- L.—Level.
- M.—Spring Check.
- N.—Indicator Hole.

PRELIMINARY.

Cut the Cord with which the Frena is sealed.

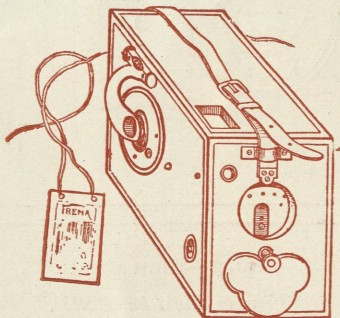


FIG. 4.

Before proceeding to take a picture, always make sure that the trefoil-shaped cover-plate is so turned down as to completely uncover the lens aperture.

**OPERATIONS TO BE REPEATED FOR
EACH EXPOSURE.**

1.—Wind the Shutter. Page 63.

This is done by turning the milled knob which projects from the front of the case, just below the lens aperture, once around in the direction of the arrow, Fig. 5.

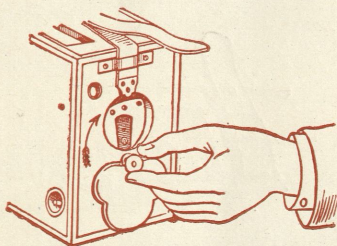


FIG. 5.

On the completion of one entire revolution a distinct click will be heard, after which the knob can be turned no further.

If the knob will not turn, the Shutter is already wound.

For instructions relative to changing the speed of the shutter, see page 65.

2.—Point the Frena to the object which is to be photographed. Page 70.

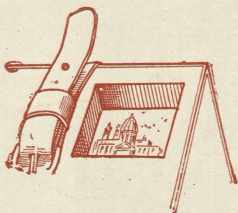


FIG 6.

Inspect the image in the Finder.

3.—Set off the Shutter. Page 74.

This is done by pressing in the bolt which projects from the right-hand side of the Frena, near the lower front corner.

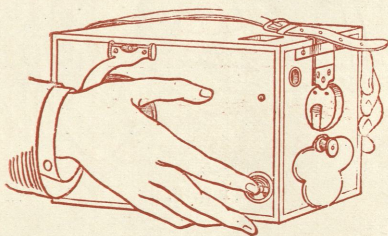


FIG. 7.

*Hold the Camera steady.
Press the Set-off gently. Do not jerk.*

4.—Change the Film. Page 83.

Hold the Frena approximately horizontal, and right way up, that is to say, with the strap-handle on top.

Release the Register Spring (K. Fig. 3) which locks the handle.

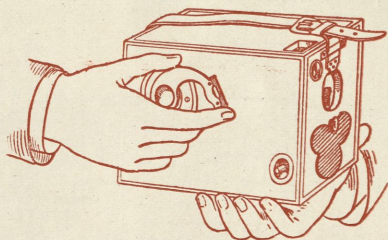


FIG. 8.

Turn the Handle backwards, *i.e.*, in a direction contrary to that in which the hands of a clock move, about five-sixths of a revolution.

Shortly before it comes to the end of its travel, the handle will be arrested by a Spring Check (M. Fig. 3,) which projects from the side of the case. Push in this check, and carry the handle over it as far as it will go.

Do not turn the handle back until it has completed its work. Should it be turned back inadvertently before passing the check, resistance will be encountered. Let this serve as a reminder that the operation has not been properly completed.

Return the handle to its normal position, permitting it to catch in the register spring.

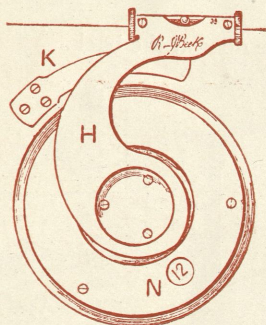


FIG. 9.

- 5.—Note the indicator reading shown by the numeral which appears in the inspection hole.

N.B.—Make it an invariable habit to perform the operations required for exposure in a regular order. Always Change the Film before Winding the Shutter.

TO REMOVE EXPOSED FILMS.**Page 92.**

Take the Frena into a photographic dark room.

Unbuckle the strap-handle.

Undo the spring-catch on the top of the case.

Open the door at the back.

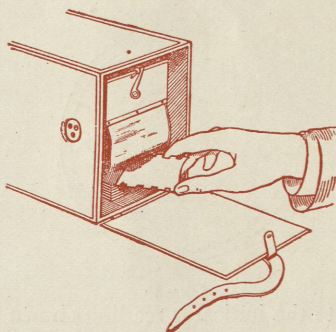


FIG. 10.

The exposed films, together with their backing cards, will be found, face downwards, at the bottom of the camera. Extract them by grasping between thumb and finger.

TO RECHARGE WITH FRESH FILMS.**Page 103.**

In a photographic dark room, open the back door of the Frena, as above directed.

Place the camera upon its lens end.

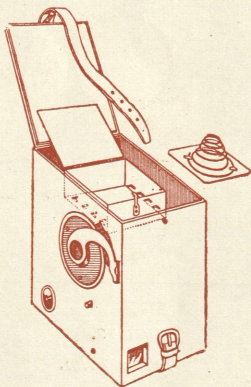


FIG. II.

Undo the catch of the Film-holder, and fold back the hinged flap.

Take out the pressure board, lifting it by the spiral spring.

If the holder be entirely empty, place in it a Dummy Film with its notches towards the sides of the camera.

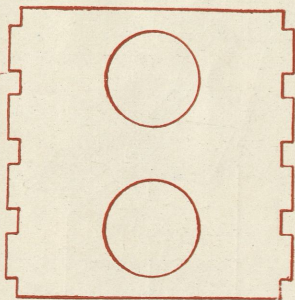


FIG. 12.

Dummy Film.

FRENA NO. 1.

The Dummy Film is made of cardboard so stiff that it is not liable to be bent and displaced by the pressure of the hand.

The Dummy Film may be conveniently grasped by inserting the thumb and fore-finger in the two round holes cut therein. It must then be so laid into the holder that the notched sides rest evenly upon the pointers.

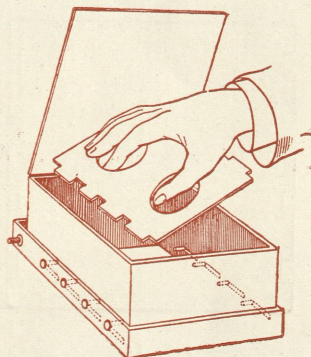


FIG. 13.

It is not necessary to make use of a Dummy Film if any Films remain unexposed in the holder. If the Dummy Film be inserted, it must be discharged by turning the handle once around before proceeding to take the picture. In reading the indicator, account should be taken of this change.

On the top of the Dummy Film, place an ordinary Backing Card with its notches towards the sides of the camera.

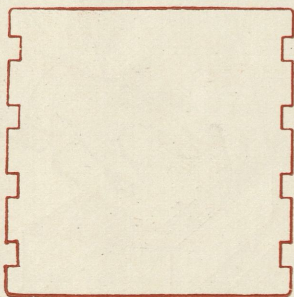


FIG. 14.

Backing Card.

FRENA No. 1.

These Backing Cards, which act as light shields, are interleaved between every film.

Proceed to fill the holder with the Films, alternating with their Backing Cards, *not exceeding forty (or two packs) in all*. Place the Films with the notches at the sides and with the sensitive surfaces downwards, *i.e.*, towards the lens.

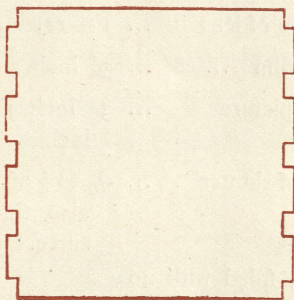


FIG. 15.
Film.

FRENA No. 1.

(Actual size, $3\frac{1}{2}$ in. \times $3\frac{1}{2}$ in.)

Replace the pressure board. Close the hinge-flap, securing it by the catch.

Close the door of the Frena, fastening it by the snap catch on the top of the case.

Buckle the strap handle.

TECHNICAL DATA.

Frena No. 1, Lantern-plate size.

Model of lens... ... "Autograph" rapid
rectilinear.

Focal length of lens ... $4\frac{1}{4}$ inches.

Aperture of lens ... F—11.

Size of film ... $3\frac{1}{4}$ inches square.

Size of picture ... 3 inches by $3\frac{1}{4}$
inches.

Speed of shutter ... $\frac{1}{80}$ to $\frac{1}{8}$ of a second;
also time exposures.

Weight, filled with 40
films ... 3 lbs.

*Dimensions of case ... 8 in. \times 6 in. \times $4\frac{1}{2}$ in.,
i.e., 216 cubic
inches.

*It may be noted, in this connection, that a certain quarter-plate camera which has hitherto been advertised as "the most compact and portable made," measures $10\frac{1}{2}$ inches \times $6\frac{1}{2}$ inches \times $5\frac{1}{2}$ inches, or over 375 cubic inches.

Section 1.

ON THE CHOICE OF THE VIEW AND ITS COMPOSITION IN THE FINDER.

ON the top of the Frena, in a square sinking near the right hand front corner, is the *View*

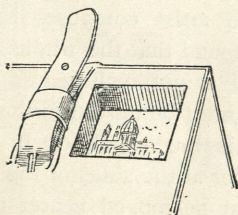


FIG. 16.

Finder, Fig. 16. Upon its ground glass is cast, by means of a secondary lens and reflector, the same image as that cast by the chief lens upon the sensitized surface within

C

the camera. The image shown by the finder is, of course, on a smaller scale, and reversed as regards right and left, but it is the right way up, and distinctly displays all the features which are included within the limit of the view.

The grouping of the picture which is to be taken may thus be done within this frame. Nothing is simpler. The photographer can, by changing his standpoint, and by altering the direction in which the Frena is pointed, compose the picture upon the ground glass as the artist composes his painting. When it is found that the whole of the subject desired is not included in the finder, the camera must be moved further away. If the image is too small, or if undesirable features occur at the sides of the picture, the camera must be moved nearer to the chief object in the scene. After a little practice the operator will acquire an almost instinctive knowledge of what will be included within the field of his lens, and will judge pretty accurately at what distance to place the camera from the chosen subject.

In the first place, a word of general warning. The beginner should be on his guard against a constant temptation which will be felt to expose the films upon all manner of inartistic and uninteresting subjects. It is unsportsmanlike to waste powder and shot for the mere sake of shooting. See to it that every negative is either a picture or a record. In the case of subjects which are not of a transitory nature, take due time for consideration, attentively studying the landscape in order to ascertain whether it will not be better lighted at some other hour. See whether shifting the point of view, a short distance to the right or left, backward or forward, will not improve the grouping. The finder is a view meter always at hand for such use.

It is, of course, to be borne in mind that the view shown in the finder is upon a smaller scale than that thrown upon the sensitive surface within the camera. The novice should be on his guard against errors of judgment in this respect. Large and awkwardly situated objects appear much more prominent upon the finished photograph. On the other hand, objects

which are very small, or which are situated at a great distance,—such, for instance, as a boat on the horizon at sea,—will often be as imperceptible upon the finished picture as they are in the finder.

One of the most common defects in the composition of hand camera pictures is the appearance in the view of an extended and vacant foreground. Let there be, if possible, some object of interest not more than ten or fifteen yards distant from the camera. In photographic prints, even more than in nature, objects are rendered prominent in proportion to the lightness of their colour, and nothing is more intolerably bare and unattractive than the broad white expanse of an unpeopled road or public square, such as often forms, as a foreground, the larger part of the picture.

One of the great difficulties in taking pictures with any hand camera is getting it high enough during exposure. In the case of most landscapes or figure subjects a picture, to look natural, should be taken with the lens at about the height of the human eye. Now, as the easiest way of holding a

hand camera during exposure is to place it beneath the arm, or to hold it against the breast, so that the image in the view finder can be conveniently examined, it results that the photographs of landscapes and street views are commonly taken from a level which is about half a yard too low. Concerning subjects of the latter class, Professor Burton has truly remarked: "There is one kind of work in which we are inclined to think a lower point of view than that of the eye when standing is seldom admissible. We refer to street scenes. We do not sit down in the street to look either up or down it . . . Nor does a man carry his head under his arm, or have his eyes in his stomach. On the other hand, a high point of view is not by any means uncommon. We constantly have it from the top of a vehicle, or out of a window." When, however, this author contends that "the camera should be held rather above than below the level of the head," he makes a demand with which few operators are able to comply. This is an awkward and conspicuous posture, and

greatly increases the difficulty of holding the camera steady. It is obvious that it could only be employed for the very shortest exposures, and that the camera, if held above the head, would have to be upside down in order that the view finder might be visible. It is, however, often possible to obtain a higher point of view by standing upon some slight eminence, and, as the extent and interest of the foreground are thus increased, this is to be recommended.

On the other hand, pictures of children, or animals of like size, are best taken from a point of view not higher than half or three-quarters of a yard above the ground. To secure this the Frenographer may kneel, or sit, and support his camera upon one knee.

For convenience in estimating the relative sizes in which figures will appear in the finished picture, the photographer who works with Frena No. 1 may bear in mind that the image of a full-grown man at a distance of four yards from the camera, will be exactly two inches high upon the film; at a distance of eight yards, 1 inch high; and at a distance of 16 yards (or about the width of the larger London streets), half-an-inch high.

Subjects moving at right angles to the line of vision require, as may be easily demonstrated, a much more rapid exposure than do subjects whose movement more nearly approaches the direction of the line of vision. For instance, a photograph of an express train at full speed, taken broadside on, at a distance of 50 yards, with a lens whose focal length is equal to that of Frena No. 1, would require, in order to give a fairly sharp image, an exposure not longer than one two-hundredth of a second. In the case of a dark subject like this, so short an exposure would, in fact, not suffice to admit the light requisite for the production of a chemical action upon the sensitive surface of the film. But by choosing a position in which the angle formed by the direction of the train to the line of vision is not greater than about forty degrees, it would be found possible at the same distance to obtain an equally sharp image with the practicable exposure of one-eightieth of a second. In taking pictures of galloping horses, rapidly sailing yachts, racing bicyclists, runners, etc., due attention

should be paid to this consideration. By devoting a little thought to the choice of a favourable point of view, good pictures may often be secured which would otherwise be found unattainable.

Let the subjects selected by the beginner for his first attempts be street scenes and landscapes, rather than portraits and groups. It is, we fear, to the inevitable failures in work of the latter class that we must ascribe the common belief that photographs made by amateurs are necessarily inferior to those made by professional photographers. This discouraging prejudice is untrue. Without doubt, the beginner, especially if entangled in a multiplicity of manipulations and processes, will, at the outset, almost always produce inferior work. And, without doubt, portraits taken by amateurs will in certain technical qualities always remain inferior to the results obtained in a well-equipped studio, with broad skylights and skilfully arranged screens, where each process is entrusted to a specialist who can make a life-long study of the particular branch to which

he devotes his attention. Yet even in the portrait the works of a thoughtful amateur are not infrequently superior in the high qualities of truthful rendering of character and personal interest, taking, as he does, his subjects in their every-day garb and postures, and keeping his work free from that debasing smoothness and fashion-plate grace which is the inevitable result of thorough retouching. It is, however, in the landscape that the amateur will meet with his earliest successes. Here opportunity is everything. Provided with a ready and so to speak infallible means of perpetuating the scenes through which he may pass, his pictures, if selected with care and intelligence, may compete on equal terms with the best work of the professional photographer.

It is, in general, ill advised to attempt to photograph a wooded landscape when the sun is not shining. Much of the vigour and relief of the picture is due to the high lights and the shadows of sunlight. Above all, windy days, however bright, should be

avoided in photographing foliage. The movement of the leaves and branches is sufficient to blur the outlines, except in the case of exceedingly short exposures.

Let it be furthermore borne in mind that the monochromatic translation of a mass of gorgeous colouring will, in many cases, not make a satisfactory picture.

It is a well-known fact that photographs cannot, without the aid of orthochromatic plates, stained screens and long exposures, all of which are beyond the scope of any hand camera, render the true tint value of the colours of the spectrum: yellow and red appearing too dark, violet and blue too light. Thus, delicate white clouds will be altogether indistinguishable from the blue sky in which they float, while a hedge or copse of summer foliage on the horizon, which is in nature of the richest green, will appear in the picture as a solid black band, cutting off the earth from the heavens. For similar reasons the position of the sky-line is a matter of even greater moment to the photographer than

it is to the painter. It is usually recommended by the text books that the horizon should be one-third or two-fifths from the bottom edge of the picture, but such a rule leaves out of account the height from which the view is seen. If the picture be taken from an elevation, with a wide expanse of landscape which must be shown somewhat as a bird's-eye view, the horizon may approach much more nearly to the top of the plate. Rules are of little avail in matters of this kind. It can, however, be safely said that a straight sky-line, especially when exactly in the middle of the plate, does not look well.

After some little experience, the operator will be able, in selecting the pictures, to see the colours of this world as the photograph will represent them. As an aid to obtaining this photographic vision, the beginner may wear a pair of dark blue spectacles, or look at the landscape through a small square of cobalt blue glass. A glass of this colour will show the view practically in monochrome.

Seen through it, foliage in the foreground will appear unduly dark in comparison with the distant landscape, precisely as it will come out in the finished photograph.

But this is by no means all. A large measure of individual thought and care is always requisite for the making of a good picture. It is true that no pursuit is better adapted than photography to cultivate the powers of observation, but this cultivation is not to be acquired without attention and analysis.

The wide capabilities and simple manipulation of the Frena offer the greatest possible aid in technical respects to the beginner in photography. But there can never be a short cut to the acquirement of artistic treatment.

The subjects capable of being depicted by photography are so multifarious, and the aspects, even of any one subject, so diverse, that those æsthetic rules which we find laid down in little books on picture-making, must be considered as worse than useless. Such formulæ can never take the place of individual taste, and attempts to adhere to them result too often in a merely mechanical arrangement of line and chiaroscuro. Nevertheless, this matter of artistic composition is one which, though it cannot be encompassed by arbitrary formulæ, yet deserves the most constant and thoughtful attention. Given a subject of interest, the artistic qualities which the photographer

should endeavour to obtain in its rendering are, above all, simplicity, breadth, and impressiveness. He will, in this endeavour, derive less assistance from the maxims of text books than from an attentive observation of the works of great artists. Let him examine analytically the composition of pictures of all kinds which he feels to be significant and pleasing. He must not expect to abstract any set of laws through such study, but he may hope that his appreciation and instinct for excellence of arrangement may thereby be increased. It is one of the greatest benefits of the practice of photography that the eyes of the operator are opened to innumerable phases of life and art which he had before left unregarded.

Section 2.

ON THE ILLUMINATION OF THE SUBJECT.

FOR the taking of instantaneous photographs the one condition of paramount importance is a good light.

That beginner adopts a safe and advisable course who takes pictures only when the sun is shining.

However protracted the exposure, photographs taken on dull or foggy days, or in the dull yellow light of morning and evening, will always be found flat and wanting in contrast.

In Great Britain the light, in clear and bright weather, may be sufficiently powerful

to permit of very rapid, or so-called instantaneous, exposures during the following hours :—

June	..	..	..	V a.m. to VII p.m
July and May	..	..	VI	„ VI „
April and August	..	VIII	„	V „
March, September and				
October	..	..	IX	„ III „
January, February, Novem-				
ber and December	..	XI	„	I „

In more brilliant light, such, for instance, as that of Southern Europe, successful instantaneous views can be obtained within wider limits.

In the determination of the point of view from which the illumination is most satisfactory, much will depend upon the taste of the photographer. It can only be stated, as a general rule, that good results are most easily obtained when the sun is shining directly upon the subject, over the operator's shoulder. If the sun is exactly behind the operator, the illumination will often be found too flat, and the shadows too symmetrical and monotonous to throw the object into vigorous relief. If, on the other hand, the sun is at all in front of

the object, there will be little else in the picture than a dark silhouette against the sky, and it will be found that, in a photograph of such shadows, the details are much less readily to be distinguished than they are in nature by the human eye.

On no account should the Frena be so held that the sun shines into the lens aperture during exposure. A totally fogged plate would be the result.

When the sun is shining brightly and there are white clouds in the sky, the illumination in the shadows will be far better under otherwise similar conditions, than when the sky is entirely without clouds. One of the most noticeable shortcomings of hand camera work is the lack of detail in the shadows. Snap-shot pictures, taken on very bright days are not unfrequently chalky white in the lights and inky black in the shadows. The fact is that the brighter the sun, and the shorter the exposure in consequence, the more this defect becomes apparent. Objects in the shade are, of course, illuminated solely by reflected light, and when the earth is carpeted with a dark verdure, as is the case in most summer landscapes, the shadows receive but little light other than that reflected from the sky. Bright white clouds on a summer day thus take the place of the reflecting

screens in a portrait photographer's studio. And hence we have the paradox that the very clearest day is not always the best for instantaneous photographs.

One other point relative to the actinic quality of light requires far more attention than is apparent at first thought. This is the reading of the hygrometer, or in other words, the relative amount of aqueous vapour in the atmosphere. Such vapour reflects a large amount of actinic light often sufficient to render the features of a distant landscape, which can be perfectly seen by the eye, altogether indistinguishable on the photographic plate. A haze, invisible to the eye, in nature, will, on sunny yet slightly damp days, hang like a veil over the background of photographic landscapes. In England the air is seldom so free from humidity that objects some miles off can be photographed with entire distinctness. This is the cause, often overlooked, of a common deficiency in photographs of English scenery. From Harrow Hill, for instance, both the Crystal Palace and Windsor Castle can frequently be seen. No photograph could possibly show them. In the perfectly clear and arid atmosphere of Colorado, on the other hand, every detail can be traced in the images of mountains more than thirty miles distant. It follows that for views of distant landscapes days should be selected when the air is comparatively free from haze. The same view taken before and after a thunderstorm will show a surprising difference in this respect.

Section 3.

ON THE DURATION OF THE EXPOSURE.

IN illustration of the wide range of photographic exposures under various conditions of light, we cannot do better than quote the words of a well-known authority :

“ On one occasion I was asked to photograph the interior and exterior of a large house. One of the interior views was a magnificent hall, with dark panelling, relieved by armour, the whole being bathed in a very subdued light. With a very rapid plate, I gave my picture an exposure of two-and-a-half hours. I then went outside the house, and took a view of the exterior, using the same stop and description of plate. The exposure was now just two seconds. Both turned out to be first-class negatives.” (Hepworth, “ Photography,” p. 42.)

This is undoubtedly an extreme case, but it is not at all an incredible one. The Frena amply provides for such variability of exposure, having a shutter with which (as set forth in the following section of this book)

the rapid exposures may readily and with certainty be altered from one-eightieth to one-sixth of a second, while there is no limit in time to the longer exposures made by hand.

The means of adjustment being thus at hand, the great question arises: What is the correct length of exposure, or, in other words, to what speed must the shutter be set for any given view? This is without doubt the most difficult problem with which photographers, whether amateur or professional, have to deal. It is one which cannot be adequately met by any empirical rule, and, even after the fundamental principles have been clearly understood, it will always require careful attention in each particular case.

Nevertheless, for those who have neither time nor patience to enter into a scientific consideration of the matter, a rule-of-thumb table may be given as follows:—

Exposures for Frena No. 1, when the sun is shining brightly, within 2 hours of noon, in May, June and July.

MARINE VIEWS—

1/80th second.

STREET SCENES—

Fully lighted by sun, $1/48$ th— $1/24$ th second.

LANDSCAPES—

No foliage or other dark objects in foreground, $1/24$ th second; with foliage in foreground, $1/12$ th— $1/6$ th second.

PORTRAITS—

Out of doors, not in direct sun, yet brilliantly lighted, $1/6$ th second; in ordinary well-lighted rooms, within ten feet of window, 4 seconds.

INTERIORS—

With light hangings and several windows, 20 seconds; with dark hangings, and one window, say 10 minutes.

For noon-day sunlight in March, April, August and September, one-half should be added to the above exposures. For February and October they should be doubled; for the three winter months, quadrupled.

It must be distinctly understood that the only value of such a table lies in the fact that it gives an approximate idea of the relative exposures necessary.

Those who desire to cultivate an independent judgment in respect to this matter of exposure, should devote careful consideration to the following points, and should repeatedly read the chapters upon the subject which will be found in the photographic handbooks cited in the introduction.

Three chief factors enter into the determination of the duration of all photographic exposures.

I. Sufficient light must have access to the film to produce upon the sensitive surface an image capable of development, otherwise the negative will be underexposed.

II. The object photographed must not have time to move perceptibly during exposure, otherwise the image of this object will be blurred.

III. The camera must not be moved during exposure, otherwise the picture will be blurred all over.

Now as to the first and most important of these factors.

I.—THE LIGHT.

Sufficient light must fall upon the sensitive surface to form upon it a chemical image, capable of subsequent development. We may put this fact in other words, by saying that the lens aperture must be opened for a longer or a shorter period, in accordance with the amount of light reflected from the object which is to be photographed. Having, as definitely determinable data for our computation, the lens aperture Frena No. 1 (F. 11), and the average rapidity of the Frena Films, as supplied by the various makers, (W.S. 28), it may readily be ascertained that a perfect photographic image of the sky, the open sea, or the similarly reflecting waters of a river, might be had, on a bright summer's noonday, with an exposure not longer than, say, one-thousandth of a second. But let there be introduced into a picture taken under identical conditions in respect to the illuminating power of the sun, any object of a darker colour, or, in other words, any object reflecting less light, such as brick buildings against the sky, a conspicuous vessel upon the sea, or a mass of foliage upon the river's bank, and these objects will be found represented upon the negative by an absolutely blank patch, appearing in the print as a black silhouette.

It is obvious that the first step towards a scientific determination of the requisite length of exposure is to ascertain the comparative actinic effect of the different colours. This may best be done by ex-

amining a photograph of the solar spectrum, and by comparing it with the visual intensity of the many-coloured band itself.

It will at once be apparent that the most vigorous photographic effect is produced by the violets and blues, the least by the yellows and reds. Between these two extremes of the spectrum the intermediate colours stand in a regular progression. Thus, green, which is about midway, will give a photographic image of greater or less intensity according as its tint tends towards the brilliant blueish green of early spring, or the yellowish hue of falling autumn leaves. It is obvious, likewise, that in the case of every colour, the depth of shade, whether light or dark, will be of direct influence in determining the photographic value.

A further step is the determination of the power of the sunlight itself, or in other words, the photographic intensity of the illumination at the time when the photograph is taken. Owing to two chief reasons, this is a matter of extreme difficulty.

In the first place, the human eye, by the contraction and dilation of the pupil, involuntarily adapts itself, within certain limits, in accordance with the varying intensity of light. This greatly affects the subjective impression which is received at different times from lights of different degrees of intensity. It is altogether exceptional that two or more lights whose photographic values are to be estimated are simultaneously in view, and can be directly compared.

In the second place, the standard of illumination for the human eye is by no means that of the photographic plate. The chemical effect upon the silver salt is produced chiefly from the violet end of the spectrum, while the compound white light which affects the eye contains a far greater proportion of red and yellow rays. Hence, a new and, to pre-conceived ideas, unnatural standard of actinic efficiency has to be continually applied in estimating the photographic value of the sunlight itself. It has been estimated that nearly one-half of the solar light which is effective in impressing the chemical image upon the photographic plate, consists of ultra-violet rays, which are not perceived by the human eye at all. Even the violet and blue rays of the spectrum, which form the greater part of the remaining half, have but a comparatively small visible effect. Now the light of the sun, in passing through the atmosphere which surrounds the earth, is shorn of a certain proportion of its ultra-violet and blue rays, and this deprivation is, of course, the more marked the more obtuse the angle at which the rays reach the earth, and, in consequence, the more extended the stratum of atmosphere which the sunlight has to traverse. Thus it comes about that the well-known reddish tinge of sunrise and sunset light is a phenomenon which produces far less appreciable effects upon the photographic plate than upon the human eye.

Hence also the surprisingly short duration of the exposures which are found sufficient in the tropics,

where the rays of the sun are more nearly vertical, and contain a larger proportion of ultra-violet and blue. Professor Roscoe has estimated the actinic efficiency of the unclouded noonday sky, at the time of the equinox, to be in Egypt more than double that of Southern England; and in Iceland, at the same season and under the same conditions, to be less than half that of Southern England.

In similar manner the presence of a scarcely perceptible ruddy haze in the atmosphere—as for instance that caused by the smoke of a large city—will have to be taken into due consideration. All murky skies introduce into the calculation of the illuminating power of the sun an extraordinary depression of the actinic value, and necessitate a corresponding increase of the photographic exposure. Under such conditions the exposure of the photographic plate will have to be prolonged far more than might at first be supposed, and in extreme cases the resulting negative, even with the most skilful treatment, cannot fail to display a certain want of definition and of due balance of light and shade. With the exception of cloud subjects and sea views, the photographer will find little satisfaction in work done in dull ruddy light.

II.—MOVEMENT OF THE OBJECT.

Theoretically speaking, it is a matter of impossibility to obtain an absolutely sharp image of any object in motion, inasmuch as the duration of the exposure would require to be infinitely small. In practice,

however, it will be found that the image of any point upon the negative will appear sharp, provided it be not displaced in its plane, during the act of exposure, to a greater distance than $1/200$ or at most $1/100$ of an inch. Even $1/50$ of an inch displacement will still give a fairly good picture. Bearing this fact in mind,—and having as data the focal length of the lens in the Frena No. 1 ($4\frac{1}{4}$ inches), the distance of the camera from the moving object, and the rapidity of the movement of the object itself,—it is easy to calculate the maximum length of the photographic exposure which may be made if an apparently perfect image be desired. Supposing, for instance, that we wish to take the picture of a man walking rapidly at right angles to our line of vision on the opposite side of an ordinary suburban street, say at a distance of 40 feet. The focal length of the lens in Frena No. 1 being about 4 inches, it follows that a movement of 1 inch on the part of the pedestrian will not blur the outlines upon the plate by quite $1/100$ of an inch. Supposing, furthermore, this pedestrian to be advancing at the rate of 4 feet a second we may feel safe in giving to our picture an exposure of $1/48$ of a second. If our man on the other side of the street be not directly opposite us, but be moving towards or from us at an angle of say 45° , it is obvious that we can double our exposure without decreasing the sharpness of the image. Looking at the matter from this point of view we may, for the Frena No. 1, compute the following table of exposures possible in the case of bodies moving at right angles to the line of vision :—

Approximate Movement in feet per second.						
	At 12 yards					
	At 30 yards					
	At 60 yards					
	At 120 yards					
Express Train.	90	..	..	..	1/80	
Freight Train.	40	..	..	1/80	1/48	
Steam-boat.	20	..	1/80	1/48	1/24	
Horse Galloping	36	..	..	1/80	1/48	
Horse Trotting.	18	..	1/80	1/48	1/24	
Carriage at Ordinary Speed.	10	1/80	1/48	1/24	1/12	
Horse Walking.	5	1/48	1/24	1/12	..	
Man Running.	7	1/80	1/48	1/24	1/12	
Man Walking.	4	1/48	1/24	1/12	..	

When the movement of the body is at 45° , or thereabouts, to the line of vision, these exposures may be doubled; when at 30° , they may be quadrupled, and yet maintain the same degree of sharpness. This fact has already been noticed in the section dealing with the choice of the view.

In regard to other subjects, the rapidity of whose movements is not so readily estimated, we shall not be far wrong in making exposures within the following limits:—

The smile of children, or other fleeting expressions of the human countenance, in taking which we may wait for a favourable instant, $1/6$ to $1/2$ of a second.

The ordinary movement of domestic animals, such as the postures of a trained dog, etc., $1/12$ to $1/4$ of a second.

Grazing cattle, $1/12$ to $1/2$ of a second.

Ordinary street scenes with many figures, taken from a window, or from the top of an omnibus, with no figures nearer than say 15 feet, $1/48$ to $1/24$ of a second.

Sailing vessels not nearer than 100 yards, $1/24$ to $1/12$ of a second.

Steamers at 100 yards, and sailing vessels at nearer distances, $1/48$ to $1/24$ of a second.

Wild animals of large size, such as caged beasts in Zoological Gardens, $1/80$ to $1/24$ of a second.

Running and trotting horses, flying birds, runners in races, bicyclists, etc., $1/80$ of a second.

The limit of rapid exposure actually admissible in such cases is, of course, determined primarily by the illumination and the colour of the subjects, in accordance with the considerations set forth under the preceding heading. When the light reflected from a body is not sufficiently powerful to allow of exposures as short as one forty-eighth of a second, pictures of running horses, railroad trains, and the like, should not be attempted at all.

III.—MOVEMENT OF THE CAMERA.

The third factor needs but few words of comment. It is clear that if, during the act of exposure, the camera is moved in such wise that the image of any fixed point is displaced, laterally or vertically, upon the sensitive surface of the film, by more than one one-hundredth of an inch, the picture will be blurred. Movement of the camera in a direct line, towards or from the object photographed, is never sufficient to enter into this calculation.

The amount of movement in the plane of the film which is liable to occur during an exposure of any given length is largely a matter of personal equation. Even the most nervous and jerky beginner will seldom fail to obtain a sharp negative with an exposure as short as $1/48$ of a second. Starting from this lower limit we find individual ability to hold a hand camera motionless to vary greatly. There are some practiced photographers of steady nerve who can obtain per-

fectly sharp pictures with an exposure as long as one half-a-second ; but this is exceptional. As a general rule it may be said that if the camera is held in the hands, and the body is not in any wise steadied, it will not be found practicable to give a longer exposure than $1/12$ of a second.

Advice concerning the means of steadying the body, holding the camera against the hip or chest, and refraining from drawing breath during the act of exposure, will be given in a subsequent section.

The actual movement of the camera is, of course, directly affected in all cases where the photographer does not stand on firm ground.

Pictures taken from a vehicle in motion, even with so rapid an exposure as $1/80$ of a second, will always show more or less blur in the foreground. Pictures taken from a railroad train in motion, with the same exposure, will give a fairly distinct image only in the case of objects which are 150 yards, or more, distant.

Moreover we have, apart from the actual speed of any conveyance, to deal with the question of jarring and jolting movements. The vibration of machinery, as for instance the engines of a factory, or of a steam boat in motion, often render it altogether impossible to obtain a sharp image. Influences of this class vary so greatly in respect to the rapidity and frequency of the shake which they convey to the camera that no fixed rules can be given. The photographer will, however, soon acquire an almost instinctive judgment as to the possibilities of steady exposure.

Section 4.

THE SHUTTER.

WINDING.

PROJECTING from the front of the camera, immediately beneath the lens aperture, is a knob with milled head.

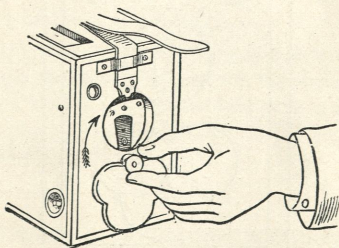


FIG. 17.

In order to wind the Shutter, this knob must be turned around one complete revolution, in the direction in which the hands of a clock move.

The operation is illustrated in Figure 17. The winding will be most easily performed by taking firm hold of the milled head and *rolling* it, as it were, between the thumb and forefinger of the right hand. On the completion of an entire revolution a distinct click will be heard, after which the knob can be turned no further.

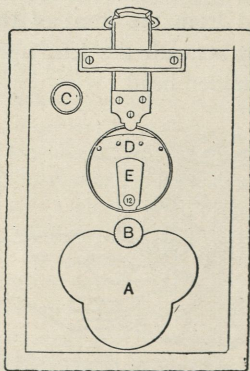


FIG. 18.

When the Shutter is completely wound the time-catch (E. Fig. 18) will be seen exactly in the middle of the lens aperture.

As this time-catch is not thus visible when the shutter is not wound, it is easy to ascertain by a glance whether the operation has been completely executed.

The Shutter cannot be overwound, nor wound twice in succession, without an intervening exposure. If, on the other hand, it has not been rewound, it will be found impossible to set it off, and thus to make exposures of indefinite speed. Absent-minded photographers will doubtless consider this a beneficent arrangement.

Make it a rule never to wind the Shutter until the Film previously exposed has been discharged from the holder.

This will render it impossible for two pictures to be taken upon the same film, and the operator will be spared the mental anguish involved in an attempt to recollect whether the foremost film in the holder has been exposed or not.

SETTING.

On looking into the lens aperture, when the Shutter is wound, there will be seen, underneath the black time-catch (E. Figure 18), the shutter time-plate of aluminium (D. Fig. 18). Near the outer, upper edge of this white time-plate are a series of

small bosses, stamped up out of the metal. By pushing sideways against these protuberances with the fingernail of the forefinger of the right hand, the time-plate can be revolved on its axis, to the right or to the left. In the lower part of the black time-catch there is pierced a small circular aperture, through which are visible a series of figures engraved upon the white time-plate. These figures, as read through the aperture, are 6, 12, 24, 48 and 80. They indicate the duration of the exposure in fractions of a second, the time-catch itself standing for the numerator. Thus the values are respectively $1/6$, $1/12$, $1/24$, $1/48$ and $1/80$ of a second. These are, in fact, the various durations of the exposures given by the shutter when the corresponding figures are visible through the aperture in the time-catch. The time-catch is so constructed that, in each of the five positions, it snaps into engagement with the time-plate, and holds it with sufficient firmness to prevent its unintentional alteration.

For those who may be interested in the principle of design embodied in the Frena Shutter, it may be

remarked that the variations in the duration of exposure are effected by varying the size of the aperture which is actually passed across the lens. The Shutter itself always runs at one and the same speed, and thus the exposures effected by this system are fixed in a definite and unalterable ratio. In this respect the Frena Shutter differs most advantageously from those shutters in which the variation of speed is brought about by varying the tension of a spring, the impelling force of which is subject to constant change, and can in no wise be so regulated as to work in any definite ratio.

When the Frena is sent out from our manufactory, the Shutter is set to a speed of $1/24$ th of a second, this being, perhaps, the most generally useful exposure for well illuminated landscapes and street views.

In order to set the Shutter to any of the other fractions of a second to which it is adapted, let it, first of all, be wound as directed above. Then introduce the fore-finger of the right-hand into the lens aperture, and, by pressing sideways with the finger-nail against the bosses on the upper part of the aluminium time-plate, turn this around, in one direction or the

other, until the denominator of the fraction desired is visible through the aperture in the black time-catch.

Ascertain that the engraved numbers are exactly in the centre of this aperture, and that the time-catch has snapped into engagement with the time-plate, so as to hold it securely.

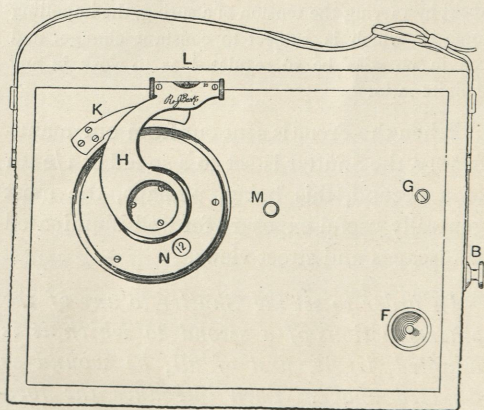


FIG. 19.

SETTING FOR TIME EXPOSURES.

First set the time-plate, as directed, to $\frac{1}{6}$ th of a second. Then pull out, as far as it will

go, the small screw-headed time-rod which will be found on the right-hand side of the camera case, near the front and above the shutter set-off. (G. Fig. 19).

To commence a time exposure : Press in the set-off bolt in the usual way. To end it : Push in the time-rod again, as far as it will go.

Further advice concerning this operation will be given in Section II, which treats specially of making Time Exposures.

Section 5.

ON HOLDING THE FRENA AND MAKING THE EXPOSURE.

Before making an exposure, the black trefoil-shaped cover-plate (A. Fig. 18) must be turned down so as to entirely uncover the lens aperture.

When the Frena is not in use it is well to turn up this plate, for the purpose of preventing the access of dust and grit to the shutter, and of rendering the camera less conspicuous by concealing the bright aluminium time-plate.

Carefully choose the standpoint most suitable for taking the picture, and approve of the grouping as displayed in the finder (concerning which compare Section 1).

The exposure may then be made by gently pressing in the bolt which projects from the right-hand side of the camera, near the lower front corner (F. Fig. 19). Continue this pressure until the click of the revolving shutter is heard.

In performing this simple operation, there is one point which requires attention, a point, however, of the very greatest importance.

The camera must be absolutely motionless during the act of exposure.

Although the time which elapses during the revolution of the shutter-plate is but a small fraction of a second, any shake or twist that may be given to the apparatus during this period will inevitably mar the sharpness of the image. To take a picture which shall be altogether free from blur, especially by any exposure longer than $1/48$ th of a second, the Camera must be held steadily, and the set-off must be released by gentle pressure, not by a jerk.

HOLDING.

The manner of holding the camera, unimportant as it may first appear, exercises a direct influence upon the finished picture, and care bestowed upon this point will always prove to be well repaid.

To hold the Frena with the greatest

possible firmness it should be grasped by both hands, all the fingers being spread out upon it with the exception of the forefinger of the right hand, which should be left in free play for the purpose of pushing in the shutter set-off at the chosen instant, Fig. 20.

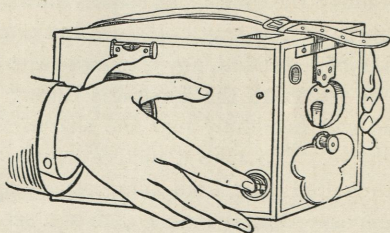


FIG. 20.

The apparatus should not be held at arm's length, but should be pressed firmly against some part of the body, so that an additional support may thereby be obtained. There are two chief ways of doing this: The one by holding the back of the camera against the chest, the other by holding its side against the right hip, or, a little higher, under the right arm. The individual convenience

of the operator will guide him in his ultimate choice between these two methods.

Let him refrain from drawing breath at the very moment of releasing the shutter set-off, and let him endeavour to prevent his body from swaying sideways. By due attention to these points he will obtain the best results possible under the circumstances of any hand exposure. Individuals, as before remarked, differ greatly in natural steadiness of nerve and hand; but by a little practice even the most nervous should thus be enabled to give hand exposures of one-twelfth or even one-sixth of a second.

If any fixed support be at hand, such as a wall or the trunk of a tree, it is most advisable to lean the body against it. Where the character of the view does not render it necessary that the camera should be elevated more than a couple of feet above the ground, the photographer may sit down, and hold the apparatus upon his knees. Moreover, the Frena itself, as it has the shutter set-off on the side, and not at the bottom of the case, may often be rested upon some stable support,

such as a gate or the pier of a bridge. This will do much in the way of insuring steadiness. *In the case of all exposures made with the time-rod, some such fixed support is imperatively required.* Hints concerning this class of work will be given in a future section.

The steadiness of the Frena having thus been the object of the photographer's special care, he must be on his guard against disturbing it by the act of making the exposure.

The Set-off bolt should be pressed in so gently and gradually that the camera is not moved at all through the force applied by the forefinger.

Whatever pressure is given by the right hand must be exactly counterbalanced upon the other side of the camera by the left hand. A marksman is always instructed by his drill-serjeant to compress and not to pull the trigger of his rifle, and a similar care should be exercised by the user of a hand camera in the delivery of his more peaceable shot. In the Frena, the resistance offered by the spring of the set-off bolt is light, and it is

perfectly possible, with a little precaution, to release the shutter without giving the slightest thrust to the camera case.

If, through want of attention to these directions, the beginner finds his pictures to be blurred, let him by no means lay the blame for this upon the definition of the altogether excellent Frena Lens: rather let him see to it that the duration of his exposure is not so long as to render it inadvisable for him to support the camera by hand alone,—that he trains himself to hold his camera steadily,—and that he does not give it a sideward jerk by the act of setting-off the shutter.

RESUMÉ.

Before each exposure :—

Make sure that the Cover-Plate is turned down.

Make sure that the Shutter has been wound.

Make sure that the Shutter Time-Plate is set to a suitable length of exposure.

Hold the Camera steady !

Press in the Shutter set-off gently !

Section 6.

ON THE USE OF THE SWING BACK AND LEVEL.

WHEN the holder containing the sensitive films is in its normal position, at right angles

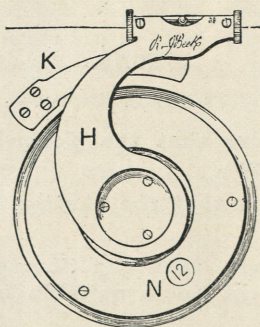


FIG. 21.

to the axis of the lens, the handle outside the case is held in engagement by a spring

register - catch (K. Fig. 21). We recommend the beginner in photography to take his first pictures with the handle thus engaged. The Frena is then in the same condition, as regards the relative positions of sensitive surface and lens, as that which always obtains in every other kind of hand-camera. It is a well-known fact that every picture which is taken with such cameras, when they are not held absolutely horizontal, is more or less out of perspective: lines which are in reality vertical and parallel appearing in the photograph to be inclined and convergent. In figure subjects and in landscapes pure and simple, *i.e.*, containing no buildings, this distortion of perspective caused by tilting the camera does not often constitute a serious defect.

The beginner can therefore take good photographs of subjects of this nature, although, while tilting the Frena, he still keeps the handle in engagement with the register-catch.

When, however, he turns to views of buildings on a large scale, to street scenes,

and, indeed, to the representation of any subjects comprising a series of upright lines, he will find that the before-mentioned distortion assumes formidable proportions. Among the customary defects of hand-camera work, none are more distressing than "drunken architectures": those inclined and tumbling lines which misrepresent buildings in reality perfectly vertical and parallel.

The Frena is the only hand-camera with which, even though it be tilted up or down, it is possible to take pictures in correct perspective. It possesses an adjustment, technically known as the Swing Back, which has hitherto been found only in the more expensive forms of tripod cameras.

In the top of the handle is mounted a small spirit-level (L. Fig. 21). If the handle be engaged in its normal position by the register-catch, the bubble of this level will, when the camera is held absolutely horizontal, be in the middle of the tube. If, on the other hand, the handle is released from the register-catch, and is turned forwards or backwards, according as the lens end of

the camera is inclined upwards or downwards, the bubble will be in the middle of the tube when the sensitive surface of the Film within the camera is actually parallel to the vertical lines of the picture. This is the essential requirement of correct photographic representation, as may be ascertained from the study of any work treating of the principles of photographic optics. Of this parallelism the Frena Level provides us with a simple and accurate test. Whatever may be the position of the camera, a glance at the bubble will show whether the image formed by the lens is in correct perspective and free from distortion.

The employment of the Frena Swing Back is attended with no special difficulties, and our suggestion that the beginner need not at first take advantage of its capabilities, has been made solely with a view to reducing the operations necessary for taking a picture to the smallest possible number. It is, as before said, never necessary or advisable to bring the Swing Back into play for views which do not comprise prominent buildings or other objects displaying a series of straight and vertical lines. For ordinary landscape and figure subjects the adjustment should be

disregarded altogether. When, however, true perspective is imperatively demanded,—as in the case of all architectural subjects,—perfect results may be obtained with a rapidity and facility hitherto unapproached.

The scope of the picture having been determined, and it having been seen from the image in the view finder that all the desired features are included in the field of the lens, it will almost always be found on consulting the level, that the camera is not being held horizontal. Were an exposure to be made under these conditions, there would be produced in the picture a distortion of perspective exactly proportionate to the angle of inclination. The handle of the Frena should, therefore, be released from the register-catch, and turned slightly forwards or backwards, as the case may require, until the bubble of the level stands in the middle of the tube. The pressure of the register-catch will be sufficient to hold the handle steady in its new position until the picture has been taken,—after which the handle may be turned back, and the exposed film discharged in the usual manner.

An exposure made when the bubble is in the middle of the tube, will, under all conditions, be in absolutely true perspective.

Under no circumstances should the handle be moved farther away from its normal position than is absolutely necessary ; better no correction at all than an overcorrection, the effect of which is peculiarly offensive to the eye.

Moreover, the handle should not be moved, whether forwards or backwards, too great a distance away from its register. It is an optical impossibility to use a Swing Back of any form without "straining" the definition and covering power of the lens. When portions of the sensitive surface are moved towards or away from the lens, they are, of course, moved out of its exact focus.

Hence it would not be advisable in the Frena No. 1, to take a picture with the handle turned away from its register by more than, say, one-quarter of an inch.

This would correspond to and correct an inclination of the camera equal to about ten

degrees. If a picture were to be taken with the Swing Back extended beyond this limit, a marked falling-off of the definition at the bottom, and especially at the top of the negative, would make itself apparent.

Yet, even this defect would at times be preferable to the horrors of a distorted perspective.

Section 7.

ON CHANGING THE FILM.

As soon as a picture has been taken, the exposed film should be discharged from the holder and transferred to the receiving chamber.

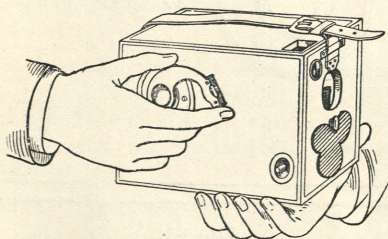


FIG. 22.

This is done by releasing the handle from the spring register-catch and turning it backwards (*i.e.*, in a direction contrary to that in which the hands of a clock move) as far as it will go, or about five-sixths of a revolution (Fig. 22).

Shortly before the handle comes to the end of its travel it will be arrested by a spring check projecting from the side of the camera (M. Fig. 23). This check must be pushed in

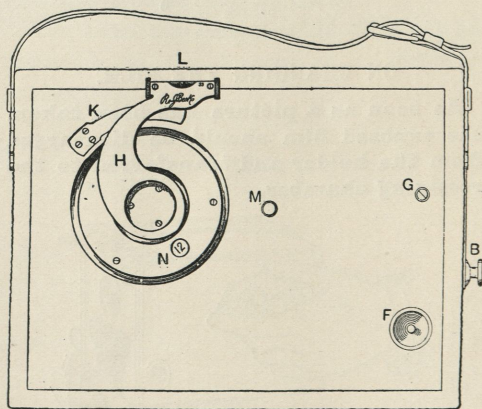


FIG. 23.

out of the way, and the handle carried over it as far as it will go, until a distinct stop is felt at the end of its course.

If the operator attempts to move the handle back again before it has been carried over the spring check,

he will find that it encounters a resistance which may serve to remind him that the operation has not been properly completed. This resistance is due to the spring of the indicator wheel; if the handle be carried backwards against this with great force, the mechanism may be injured.

When the handle has gone round as far as it will go, past the spring check, it must be turned back again to its normal position, into engagement with the register-catch.

The before-mentioned spring check will not interfere with the movement of the handle on its return journey.

During the act of turning the handle, the Frena must be held the right way up, that is to say, with the strap on top, and in an approximately horizontal position.

These operations discharge the foremost film, with its accompanying card, and at the same time bring the succeeding film of the pack into the exact focus of the lens, ready to receive the next photographic image.

Section 8.

ON READING & SETTING THE INDICATOR.

It will be observed that a small circular aperture is pierced in the disc of metal which

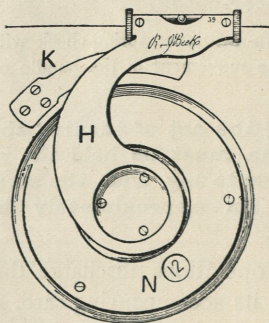


FIG. 24.

surrounds the axis of the handle (N. Fig. 24). The numeral visible through this aperture shows the number of the film which is in position for the next exposure. Every time

that the handle is turned down, one photographic film, with its accompanying backing card, is deposited in the receiving chamber, and at the same time the indicator is advanced one number. The numbers upon the indicator run from 1 to 20, corresponding with the score of films contained in each pack. When the twenty-first film is in position, the indicator will begin again at 1.

It is advisable, when replenishing the Frena, to put an entire pack of twenty films into the holder at once. If this be done, and if care be taken to refill the holder before the previous charge is entirely exhausted, that is to say while at least one unexposed film, with its backing card, remains therein, it will never be necessary to employ dummy films for the purpose of loading, and never necessary to change the indicator reading.

If the Indicator is disarranged, it may, when the camera is completely empty, be easily shifted so as to show any one of its numbers by turning down the handle once for each change to a consecutive number, as many times as may be necessary.

Should, however, it become desirable to alter the reading of the Indicator, while the camera contains unexposed films which are not to be discharged, this may be done by the following method:—Take the Frena into a photographic dark room. Open the back door. Turn the handle back exactly one-quarter of a revolution, so that the film holder becomes horizontal, or, in other words, parallel to the top of the camera. Then insert the middle finger of the right hand above the film holder, so as to touch the teeth of the indicator wheel, which is centred upon the axis of the handle, on the right-hand side of the case. This indicator wheel may then be pulled around towards the operator. As each one of the twenty teeth is revolved it will sound one click. This sound does not, however, signify the change of one unit in the numerals of the Indicator. Each click advances the number shown upon the outside of the case by 7, the consecutive figures reading as follows:—

1,—8,—15,—2,—9,—16,—3,—10,—17,—4,—11,—
18,—5,—12,—19,—6,—13,—20,—7,—14,—1,—&c.

From this sequence it may easily be ascertained how many clicks of the indicator spring are required in order to change the reading from any given figure to any figure that may be desired. Thus, to go from one to two will require three clicks; to go from two to one will require seventeen clicks, &c., to be made by hand.

To avoid all necessity of troubling himself with these processes, the photographer is again advised to always replenish the holder with an entire pack of twenty films at once, and never to discharge the last, twentieth, film of the former series until the new pack has been placed in the holder behind it. This last, twentieth, film of the previous series may, of course, be exposed in the field ; but it should be left in position in the holder until the Frena is taken into the dark room and refilled, after which operation the twentieth film (which has thus a function comparable to that of a "caretaker" left in a house between two sets of occupants) may be discharged from the holder for development.

Section 9.

ON REMOVING EXPOSED FILMS AND RECHARGING.

BEGINNERS in photography must be reminded that the films employed in the Frena are extraordinarily sensitive to light, whether artificial or daylight. The high degree of this sensitiveness may be judged from the fact that the light of the sky, even though admitted only through the comparatively small aperture of the lens, and for the inconceivably short period of $1/1000$ of a second, is sufficient to produce, on development, a dense black deposit upon any film exposed thereto. The process of introducing the films into the Frena requires but a few seconds, yet the only light by which this operation can be safely performed is that given by the subdued deep red illumination of a photographic dark-room.

It is scarcely necessary to add that the door at the back of the Frena ought never to be opened excepting in such a dark-room. This door opens the chamber in which the sensitive films are stored, and if the faintest ray of white light gains access thereto all the photographs will be hopelessly fogged.

Those operators, however, who have not access to a regularly constructed photographic dark-room, can almost always arrange for themselves a temporary substitute which will suffice for the changing and packing, if not for the development, of their films. The writer has often, in broad daylight, shut himself into a tightly-closing hotel wardrobe for the purpose, or improvised a diminutive tent by propping up the bedclothes upon an open umbrella. A more convenient plan is undoubtedly to wait until night-fall, when the windows and doors of most rooms can be completely shut off from the lights of the street and corridors by blinds and hangings. The necessary illumination may then be derived from a folding ruby lamp,—from the stump of a candle placed in a hat-box and securely shielded by several thicknesses of red tissue paper,—or even, in extreme destitution, from the glowing end of a post-prandial cigar.

One of the many advantages of Frena Films is that, as they are supplied by the makers in a firm pack, which can be placed in the camera without being

separated, only the foremost sensitive surface need be exposed to the dark-room light at all. Light-fog will thus but rarely be found to extend beyond the first film.

A.—TO TAKE OUT EXPOSED FILMS.

Any single film that has been discharged from its holder can be withdrawn from the Frena for development without disturbing the stock of films which have not been exposed. There is no cutting up or waste of negative material involved in removing the films one by one, as may be convenient. On the other hand, the entire charge of films contained in the Frena can, if preferred, be exposed consecutively, and not removed from the camera until the apparatus is to be refilled.

The removal of exposed films from the Frena is an operation of the utmost simplicity.

In a photographic dark-room open the door at the back of the case by unbuckling the strap-handle, and unfastening the spring-catch which is beneath it. The exposed films, interleaved with their backing cards, will be found lying

in a pack upon the bottom of the camera, whence they may readily be removed by grasping them between finger and thumb (Fig. 25).

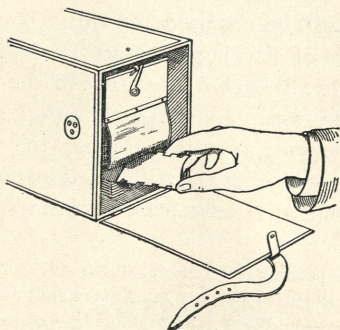


FIG. 25.

The photographer should refrain from touching his films at all, unless he is sure that his fingers are perfectly dry and free from traces of photographic chemicals. In any event, he should handle the sensitive surface as little as possible, grasping the films, whenever practicable, only by the back and edges. The imprint of damp fingers upon the bromide or silver emulsion will almost always become visible on development, and such marks do not tend to improve the appearance of the finished picture.

After being removed from the camera the pack of exposed films must be at once protected from the light. At least four thicknesses of non-translucent paper, securely folded, will be required for this. The best methods of packing exposed films are, undoubtedly, to enclose the pack in the set of envelopes which are supplied for the purpose, or to employ, for rewrapping, the tissue paper, black paper and triple cardboard boxes from which the next pack of fresh films is taken.

If such packing materials of known efficiency be not at hand, the Frenographer must make shift as best he can. He should bear in mind that it is generally safer to take for the innermost wrapper, which comes in contact with the films themselves, a thin brown paper, rather than any kind of white paper, inasmuch as the latter often contains hyposulphite of soda (a chemical most destructive of the sensitive surface), which is used by many paper-makers as an anti-chlor in the process of bleaching. Brown papers are sold at so cheap a price that it would not pay the manufacturers to put chemicals of any kind into them.

If the exposed and undeveloped films are to be sent about the world by post, it is well to reduce their bulk and weight by removing

the packing cards from the pack, otherwise it is preferable to leave these cards between the films, where they often serve as light-shields.

When the films are securely packed, they should be at once sealed, so as to prevent the opening of the wrappers through accident or meddlesomeness. The full development of the faculty of inquisitiveness, in the case of hotel servants, as well as other members of the human species, is known only to that photographer who puts away packages of exposed plates in unsealed wrappers. And this is a form of knowledge, the acquirement of which is not attended with satisfaction.

B.—FRENA FILMS.

The Frena, as is well known, takes pictures on thin and stiff sheets of transparent Celluloid Film, the only perfect substitute for glass yet invented. These sheets are almost exactly one one-hundredth of an inch thick, that is to say, about the thickness of a visiting card. They are so prepared as to remain perfectly flat during exposure. Even after development they have but little tendency to curl.

The films used in the No. 1 or lantern size Frena are three and a-quarter inches square. The weight of twenty such films

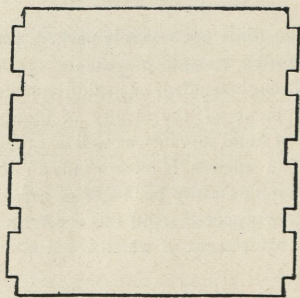


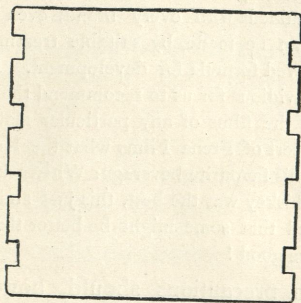
FIG. 26.

FILM. FRENA NO. 1.

is only one ounce and a-half, while the weight of twenty glass plates of the same size is as many pounds.

The edges of each film are notched, as shown in Fig. 26. Between each film is packed a Frena card, two edges of which are notched, as shown in Fig. 27. The purpose of these cards is to prevent the light admitted through the lens from penetrating

to the sensitive surface of the succeeding film. At the same time they almost entirely obviate that blurring of the image caused by



BACKING CARD. FRENA NO. I.

FIG. 27.

light reflected from the back of the negative, which is technically termed halation.

Frena Films are prepared by various manufacturers, whose products differ in certain particulars, and notably in respect to the character of the sensitive emulsion. Each make will, in consequence, display slight peculiarities in working. The operator is strongly recommended to choose one brand, and to persevere with it until he has thoroughly mastered its treatment with the one developer which, for like reasons, he has adopted as a standard. As the owners

of the Frena trade mark permit only sensitive films of approved excellence to be supplied under this name, which may thus be taken as a guarantee, the photographer may rest assured that first-class results can be obtained with every brand, even as good negatives can be made, by suitable treatment, with every approved formula for development. Hence, it would be invidious for us to recommend the beginner to take up the films of any particular maker. We can only assert of Frena Films what the Kentuckian asserted of his favourite beverage: When asked which brand of whiskey was the best, this just and cautious man replied that some might be better than others, but all were good !

Certain precautions should, however, be observed in the storage of films, as of glass dry-plates. The packages should be carefully protected from dampness, to the influence of which all sensitive photographic surfaces are exceedingly susceptible. Passengers at sea should pack their supply in tin-foil or in air-tight tin cases. Films should furthermore be guarded from the fumes of gas, which will cause the emulsion to degenerate rapidly. They should not, for instance, be stored in any room which is lighted by gas, and, if this be

unavoidable, they should not be placed on high shelves, but near the level of the floor. With proper care, Frena Films will keep their good qualities unimpaired for many years, and it is one of the many advantages of films, as compared with glass plates, that the manner in which they are packed naturally tends to preserve them more perfectly from the atmosphere, and from the deteriorating effects of moisture and gases.

C.—THE FILM-CHANGING MECHANISM.

Before attempting to recharge his apparatus with fresh films, the Frenographer ought to understand the mechanism by means of which the separate sheets are released from the holder in which they are exposed, so as to be deposited in another pack or series upon the bottom of the camera. For this purpose he should, when the first charge of films has been exposed and removed, examine and test the interior mechanism of the apparatus in broad daylight.

Let the handle be turned to its normal position, in engagement with the register-catch upon the out-

side of the case. The holder will thereby be locked with its vertical axis at right angles to the axis of the lens. Upon opening the door at the back of the camera it will be seen that a square holder of metal is swung upon axes supported by the sides of

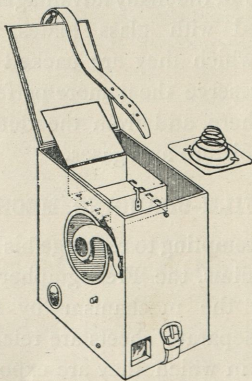


FIG. 28.

the case. It is in this holder that the films, interleaved with cards, are placed, one behind the other, each film having its sensitized surface towards the lens. The photograph is taken upon the foremost film of the series.

The hinged flap which closes the holder should then be opened by unfastening the catch upon its upper edge. Folding down this flap exposes the

spring pressure-board which serves to keep the films in position. (Compare Fig. 28). Remove the pressure-board, grasping it by the spiral spring. It will then be seen that the holder is quite open in front, except for a series of pointers or sorting teeth, four on each side, which project inwards to a distance of one-tenth of an inch. The foremost film will always be pressed against, and supported by, these pointers.

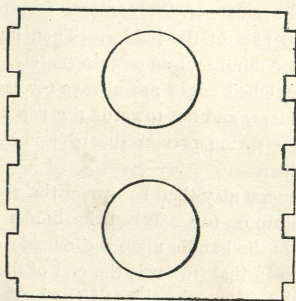


FIG. 29.

In order to test the changing mechanism, place in the holder a number of exposed and developed films, alternating with backing cards. The first film to be placed in an empty holder should invariably be a Dummy (Fig. 29), which is supplied by the makers for convenience in making a first charge. This Dummy

Film is of precisely the same outline as the ordinary sensitized films, but it is much stiffer, so as to rest securely upon the teeth, without bending under the pressure of the hand, and it is perforated with two circular holes, so that it may be conveniently grasped. Stand the Frena upon its lens end so that the holder is horizontal, and that the films may lie face downwards. Insert thumb and forefinger in the holes of the Dummy Film, and place it in the empty holder, in such wise that it rests evenly upon the pointers, with its notches towards the sides of the camera, *i.e.*, towards the handle and axis of the holder. Then lay upon it a card, then a film, and so on, alternately, taking care that the notched edges are always towards the sides of the camera, and not towards the top and bottom. Replace the spring pressure-board, and close the flap of the holder.

The camera may then be turned the right way up, with the strap on top. When the holder is revolved, by means of the handle upon the outside of the case, it will be seen that, towards the end of the travel, the pointers slide down the sides of the holder until they come to the notches cut in the films. The first film being thus no longer supported, drops upon the bottom of the case. The card which is behind the film is, however, supported by the pointers while in their secondary position, owing to the fact that the notches in the card are not coincident in position with the notches in the film. On turning the handle still further, beyond the spring-check on the outside of the

case, the pointers will return to their original positions, in which they correspond with the notches in the card, so that this latter drops on top of the film just deposited. It is only the foremost film of the series and its companion card which are affected by this manipulation; the remainder of the pack being retained in the holder. Turning the handle back replaces the holder in position for taking the next photograph.

Thus, it will become evident that every time the handle is turned backwards and forwards through an arc of about 300 degrees, one film and its following card are discharged from the holder, and deposited upon the bottom of the camera, leaving another sensitive surface in position in the focus of the lens, ready for the next exposure.

The series of discharged films, stored in the receiving chamber are protected from the light admitted through the lens, and prevented from falling into the body of the camera by means of a flexible septum, one end of which is attached to a transverse partition, and the other to the flap at the back of the holder. This septum is moved out of the way of the dropping films and cards by the revolution of the holder.

D.—TO RECHARGE THE FRENA.

The Frenographer who has attentively followed the preceding paragraphs will have

no difficulty in recharging his apparatus. Two precautions are, however, essential.

In the first place, the Films and cards must always be placed in the holder with their notched edges towards the sides of the camera.

A film or card placed in the holder with its notches the wrong way, that is towards the top and bottom of the case, would, of course, not be discharged at all. On opening a parcel of Frena Films, it should be found that all the notched edges are upon the same sides. It is well to glance at the edges of the pack, and make sure that this is the case.

In the second place, the sensitized surface of the films, or in other words, that side upon which the gelatine emulsion is spread, should be placed towards the lens.

On opening the parcel of films, it will be seen that at one end of the pack is a white film, and at the other is a coloured card. The pack should consequently be inserted in the holder with the white sheet towards the front of the camera. If a single film should

become separated from the pack, the sensitized side can be distinguished by its duller surface. The back of a film, the uncoated celluloid side, is polished and more or less shiny.

When a film has, through inadvertence, been placed in the camera with its sensitive surface the wrong way about, the picture taken upon it will be reversed as regards right and left. This is, in itself, not a very serious matter, as the prints can, if necessary, be made from the back of the film; but the image will be found to lose in distinctness through such a process of double transfer.

One of the many advantages of employing such films as are supplied by makers in packs which may be placed in the camera without separation, is that no dust can possibly accumulate upon the sensitive surfaces. It is hence quite unnecessary to brush the face of each individual film in the way that is customary for glass dry-plates, and there is no risk of thus scratching the delicate surface of the emulsion.

Having then, in a photographic dark-room, or in its equivalent as regards non-actinic

illumination, placed the Frena upon its lens end, open the back door, unfasten the flap of the holder, and remove the pressure-board. (Fig. 30).

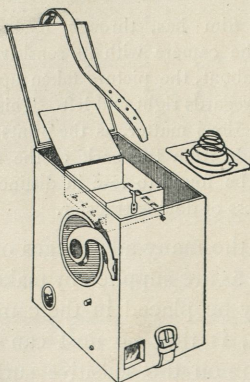


FIG. 30.

If there remain in the holder any films, with their backing-cards, and it is merely required to add to their number, the additional films and cards may be dropped into the holder, either one by one alternately, or by preference, as an unbroken pack.

When there remains in the holder but a single film, with its backing card, care should be taken that the position of this film upon the pointers is not disarranged during the process of refilling. It should not be submitted to uneven pressure by the pack inserted behind it, nor be bent down by the fingers of the operator. For the sake of perfect security in such a case, it is advisable to separate from the fresh pack the first two or three films, with their alternating cards, and to drop these lightly into the holder, before the remainder of the series. The layer of three or four films and cards thus formed in the holder cannot readily be bent out of engagement with the pointers, and the rest of the pack may then be inserted without further separation.

Not more than one entire pack of films should be added at a time, and the total number of films in the holder should at no time exceed forty.

Replace the pressure-board, close the hinged flap, and shut the back door of the camera. The fresh supply of films will then be ready for exposure.

By turning the handle round half a revolution, so that the holder faces the back of the camera, it can be seen whether the foremost film rests evenly upon the pointers, and thus insures the regular discharge of the following pack.

It is strongly recommended that the Frena should invariably be replenished by one entire pack at a time. Separate films, if taken from the pack, and left in their wrappers, are exposed to various deteriorating influences, from which they are secure while under pressure in the holder. Moreover, much bother and uncertainty may be entailed by such a breaking up of the series. These disadvantages will be especially felt in the case of beginners, unaccustomed to work in the dim illumination of the dark-room. If an entire pack be always added to a few unexposed films remaining in the holder, the indicator will not only prove how many pictures have been taken, but will also show how many films are still in the camera, ready for exposure.

With this recommendation is to be coupled the advice already proffered: that the stock of films in the Frena should not be entirely exhausted before being replenished. The twentieth and last film, even though exposed in the field, need not be discharged from the holder until the next pack has been placed behind it.

Should, nevertheless, the holder be actually empty, the recharging must be begun with the Dummy Film, as before described. If a

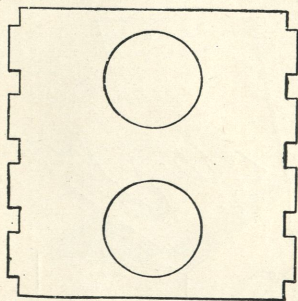


FIG. 31.

flexible celluloid film were to be placed at once in an empty holder, it might possibly be bent by the pressure of the hand so as not to rest evenly upon the pointers, and an irregular action of the changing mechanism would be the result. Take, therefore, the empty Frena out of the dark-room into broad daylight. Turn the indicator, as directed in a former section, to the numeral 20. Place in the holder a Dummy Film,

with its notched edges towards the sides of the case, so as to rest evenly upon the pointers. On the Dummy Film place a

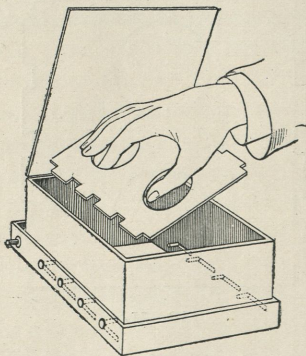


FIG. 32.

backing-card. Return to the dark-room, and add the pack of sensitive films, with their backing cards, as directed. Then replace the pressure-board, close and fasten the flap at the back of the holder, and, after turning the camera the right way up, with the strap-handle on top, move the handle once round, so as to discharge the Dummy Film together

with its card, which may be removed at once from the receiving-chamber. After this one revolution of the handle, the indicator will show the numeral 1, for the first film of the new series.

Before leaving the dark-room with a newly-filled Frena, make sure that the back door is securely fastened by its spring catch, and that the strap, which forms an additional security against accidental opening, is buckled.

Section 10.

ON PACKING AND FORWARDING THE FRENA AND FRENA FILMS.

ONE of the great advantages of Films is that packs of exposed sheets or of finished negatives, can be sent by post to all parts of the world, without danger of breakage, and at small expense. For instance, the postage payable on a package of twenty films with their cards, as supplied by the makers, is, within the limits of the United Kingdom, when sent as a sealed letter, only twopence half-penny. Three such packages can be sent by Parcel Post for threepence.

When exposed and undeveloped films are to be forwarded by post, they must be sealed and prepaid according to the regulations and rates which govern the transmission of ordinary letters. Any package sent by Book or Sample Post is liable to be opened for examination by the officials of the Post-Office.

Let the backing cards be removed from between the exposed films, as suggested in the former section, and

let the pack be securely protected from light, in opaque wrappers, as above directed. It is advisable to still further protect the parcel by enclosing it in a light pasteboard box, such as that in which the fresh films are sent out by the makers; this additional casing will prevent injury of the sensitive surfaces by the blow of the date stamps to which postal packages are subjected. Pressure marks, invisible to the eye, will often become apparent on development.

When films have been developed and dried they may be sent by post in much simpler packages, and at cheaper rates. Four or five Frena negatives, which may be exposed to light without being injured, can be enclosed in an ordinary one-sheet letter without increasing the penny postage. Larger parcels of film negatives can be sent to foreign countries within the Postal Union by book-post, at fourpence per pound, that is to say, at the rate of one penny for fifty or more films.

It is important that film negatives should be varnished, before being sent about from place to place. They are thereby not only protected from injury by abrasion, but are rendered less susceptible to the deleterious effects of dampness, to which they will always be more or less exposed, in mail bags, and in the hands of postmen on rainy days.

For those who are not able to improvise a dark room, wherein they can themselves remove the exposed films, and recharge the holder, it will be found a safe, if somewhat roundabout plan, to send the entire Frena, unopened, to us, at the address given on the title page of this book. The apparatus will be returned immediately, recharged and ready for a further series of exposures. At the same time the exposed films will be removed and developed. Prints of the pictures taken can be supplied thereafter in any desired number.

Those who desire to adopt this simplest conceivable system of picture-making, will find that the Frena travels safely by Parcel Post. Let the camera be packed in a strong cardboard or light wooden box of suitable size, with a stuffing of crumpled paper or other soft material at the sides, so that it does not shake about. Around the box secure one thickness of stout paper, upon which the address should be written. Parcel Post charges must be prepaid. Do not omit to write distinctly upon the outside of the package the name and address of the sender, as this serves as the means of identification. Then inform us by letter, in the same mail, how many prints of each picture are desired.

round hole in the time-catch. Then pull out, as far as it will go, the small screw-headed time rod (G. Fig. 33) which will be found on the right hand side of the camera case near the front, and above the shutter set-off.

To commence a time exposure : Press in the set-off bolt (F. Fig. 33) in the usual way.

Determine, by means of a watch, the exact duration of all time exposures longer than three seconds.

To end a time exposure : Completely and firmly cover the lens aperture with the hand, or preferably, with a handkerchief, cap, or the like. Then quickly push in again the before-mentioned time-rod as far as it will go. On doing this, the shutter will be heard to click, as the course of its further revolution is arrested. The hand or handkerchief may then be removed from the lens aperture, as the light can no longer gain access to the sensitive surface within the camera. The exposed film should then be discharged and the shutter re-wound.

As before said, it is absolutely necessary, in the case of all exposures made with the

time-rod, to place the Frena upon some fixed support. This support may be any object having at a convenient height a level surface not smaller than the bottom of the camera. The top of a wall, the balustrade of a bridge, a window sill, mantel-piece, or a table, will often be found available for this purpose. In the great majority of cases it will not be advisable to place the camera upon the earth, owing to the consequent exaggeration of the foreground; yet a satisfactory arrangement of the picture may occasionally be thus obtained, as for instance, when the point of view is the brink of a gorge or other declivity.

If the grouping renders it desirable to incline the axis of the lens slightly upwards or downwards, this can be done by propping one end of the camera upon some object of suitable size and shape, such as a bit of board or a walking stick. Even a folded handkerchief placed beneath one end of the Frena will be found to make an appreciable difference in the scope of the picture.

Whatever the nature of the support, the camera must be free from any tendency to wobble, or otherwise to alter its position during exposure. Unless the exposure is

very long, say more than four or five seconds, or unless the support is not absolutely rigid, it is advisable to keep the left hand pressed firmly downwards upon the top of the camera during the operation, thus counteracting the slight thrust which has to be given to the shutter set-off by the forefinger of the right hand.

Concerning the length of time during which the lens should be left open, it is not practicable to give instructions more definite than those which are contained in Section 3. As time exposures need be given only in the case of exceptionally dark subjects, or under exceptionally weak illumination, it is obvious that no rules could possibly admit of general application.

In view of the large aperture of the Frena lens, and the extreme rapidity of the Frena films, it may be doubted whether those out-of-door views which are not sufficiently well lighted to give a full exposure to the film in the sixth of a second provided by the shutter adjustment, will not prove to be too feebly lighted to give a distinct photographic image in any more protracted period. Hence the Frena, when

employed for landscape work, should be chiefly regarded as a camera for rapid shutter, rather than for time, exposures.

INTERIORS.

The case is altogether different with pictures taken indoors. Here time exposures will almost always be found to be absolutely necessary.

When taking the photograph of an interior, certain precautions should be observed in selecting a standpoint for the camera, and in determining the scope of the picture by means of the finder. If circumstances render it possible to so arrange it, no windows should be included within the field of the lens, as the direct glare of light admitted through them will tend to blur the image. Thus the most advantageous standpoint for the Frena will usually be found to be close to that wall in which the windows are pierced. If the room be at the corner of the building and be provided with windows on two of its sides, the outermost angle will almost always be the best position. Should it, however, prove impracticable to exclude all the windows from the picture, it will be a good plan to diminish the light from those which come within the field of the lens, by pulling down their blinds or by drawing their curtains.

The time required for exposures in interiors is subject to enormous variations, dependent

upon the amount of light admitted to the room, and upon the colours of the walls and hangings. On a summer noonday, with bright sun out-of-doors, a small room lighted by two windows, and having whitewashed walls, would probably not require a longer exposure than one or two seconds. But a case has been referred to above (page 50), where a large hall with dark panelling, in subdued light, was found to require an exposure nearly *five thousand times as long* as that which sufficed for a view of the exterior of the building.

The writer is acquainted with an eminent authority who invariably replies, when asked what length of exposure should be given to this or that interior, "try five minutes, and then see what you get on your negative." Interiors, fortunately enough, do not belong to that class of transitory subjects which present themselves but once to the vision of the photographer; they stand steadily, and can be taken again and again, until a satisfactory result is at last secured. If the interior be in a house which is provided with a photographic dark room, it will be advisable to at once develop the film upon which the view is taken, and, guided by the indications of under or overexposure thus obtained, to repeat the operation with the duration of the exposure considerably modified.

Section 12.

DEVELOPMENT.

WHEN a sensitized photographic film is exposed in a camera, a latent chemical image, invisible to the eye, is imprinted upon its surface by the flash of light which is admitted through the lens during the revolution of the shutter. In order to transform this latent image into a visible negative representation of the scene depicted, the exposed film must be subjected to the action of certain chemicals.

Black metallic silver is thereby precipitated in those parts of the bromide of silver emulsion which have been acted upon by light. This process is termed *development*. When it has been carried sufficiently far, all the bromide of silver which has not been affected by light, or has not been precipitated by the developing chemicals, must be dissolved out of the film by placing this in a solution of hyposulphite of soda (commonly spoken of as "hypo"). This secondary process is termed *fixing*.

The image which is thus obtained is called a *negative*, because it is the reverse of the natural scene in respect to light and shade: the sky, for instance, being dense and black, while the dark fence outlined against it is light-coloured and transparent. By again reversing this negative image, through the process of printing upon sensitized paper, a photographic *positive* may be obtained, the lights and shades of which are like those of the natural scene.

It is by no means necessary to develop a film as soon as the exposure has been made upon it. So long as the sensitized surface is effectively protected from the further action of light it will retain, without alteration, the latent image impressed upon it. Its development may hence be deferred, as is often desirable in the case of an extended journey, for weeks, or even years.

All the operations of development must be conducted in a photographic dark room, from which every trace of actinic light has been excluded. The nature of such a dark room has been already set forth in describing the precautions which are to be observed in

removing exposed films from the Frena (page 91).

Let the effectiveness of this exclusion be tested by the operator remaining for several minutes in his dark room, with the red window closed, and without a red lamp. The eye will then, through the enlargement of the iris, be enabled to detect any ray of the outer illumination which may leak in through crevices previously overlooked.

It is furthermore important that the light of the dark room should be sufficiently subdued, and of a sufficiently deep ruby colour.

If the operator finds that his films are liable, when placed in the developer, to darken all over in a way otherwise inexplicable, he should test the non-actinic quality of his dark room illumination by exposing to the direct rays of his ruby window, or lamp, a fresh film, one portion of which is masked by a strip of black paper, or by a coin laid upon it. The film should be thus exposed within 2 feet of the window or lamp for about a minute. Then let it be developed in the usual manner. If a light-coloured image of the paper strip or of the coin becomes apparent upon the sensitive surface, it will be evident that the red light admitted to the dark room should be either rendered of a deeper tint, or decreased in quantity.

Although any well enclosed space may suffice for changing the films and recharging

the Frena, it will be found inconvenient to fix and wash a large batch of negatives in a room not provided with a water-tap and sink. Many kitchens and bathrooms are nocturnally appropriated by amateur photographers who have these advantages in view. In default of running water, let a large jug and slop pail be provided; and let it be borne in mind that the colder the water used for development the better. Warm water will tend to soften and frill any gelatine film.

Every formula for development which gives good results with glass plates is equally applicable to films. Hence the photographer may, if he prefer, follow the instructions for development with iron, pyrogallol, hydroquinone, eikonogen, &c., which are to be found in the various text books of photography cited in the introduction (page 6), and also, in compendious form, in the excellent annuals and year books of the English photographic journals.

Let the beginner, however, thoroughly master one method of development before experimenting with others. Good results are obtainable with every one of the formulæ in general use, and the beginner must not lay the flattering unction to his soul that his failures to produce good negatives may perchance be due to that particular chemical which he has selected.

The developer which we would recommend to the beginner, as providing the simplest method of negative making is that which employs a single concentrated solution of a new and complex chemical, prepared, ready for use, under the name Frenöl. Ten or twelve drops of Frenöl will, without other additions, transform an ounce of water into an efficient developing bath. It will suffice for our present purpose to give directions for developing by this method alone.

The apparatus for development should consist of :—

Dark room lamp.

Trays for development, rinsing, hardening and fixing.

Washing rack and tank.

Measuring glass, 2 oz.

Dropping bottle, 1 oz., for Frenöl.

The following chemicals will be required :—

One small bottle of Frenöl.

Common Alum, in powder, say 2 oz.

Hyposulphite of Soda, in crystals, say 1 lb.

Care should always be taken to insure the cleanliness, in a chemical sense, of all dishes used for development. Some amateurs have been known to use one and the same tray successively, for developing, rinsing, hardening and fixing their films,—and even for the toning of their prints. A large proportion of spotty and foggy negatives will be the inevitable result of such methods. It is strongly recommended that a separate tray should be devoted to each purpose, and that the vessels used for development and toning should be thoroughly washed after each operation.

DEVELOPMENT.

Arrange the trays in the order in which they are to be used. Take the film to be developed, being careful not to touch the sensitive surface with damp fingers (compare page 93),—and lay it, dull gelatine side uppermost, in a clean developing tray. Pour over the film enough plain water, say two or three ounces, to entirely submerge it. Let it soak therein for half a minute or more, shielding the film from the light of the dark room window, or ruby lamp, by covering the tray with a piece of stiff paper or pasteboard. Then pour all the water off, into a washing tray, and flood the film with the developing

solution. This may be prepared whilst the film is soaking, by mixing—

1 part of Frenöl with 40 parts of water.

This is in the proportion of twelve drops of Frenöl to each ounce of water. Make a sufficient quantity of developer to completely submerge the film; one ounce and a half will suffice if the small trays supplied for the Frena film No. 1 (lantern size) are used. If any portion of the film should project above the solution, the development would be uneven and the negative spoiled. In about a minute the high lights of the picture, such as the sky in a landscape, or the face in a portrait, should begin to make their appearance, as dark patches upon the white surface of the film. The development having thus commenced, the tray should be covered again with a sheet of stiff paper or pasteboard, and the film should be allowed to remain submerged in the developing solution for at least five minutes longer. At the end of that time examine the density of the black patches by transmitted light, holding the negative between the eye and the dark room window or

lamp. As the gelatine coating is exceedingly tender when wet, and is hence very liable to be scratched by the finger nails, this is an operation which must be performed with the utmost precaution. The film should be held only by its edges, and be lifted from the bottom of the tray, if necessary, by carefully inserting the point of a pin beneath it.

Developing dishes of transparent celluloid, such as those which are supplied with the Frena outfit, greatly facilitate this inspection. They are provided at one end with a well for holding the developing solution, while the entire tray, with the film lying in it untouched, is held up in front of the window or lamp.

Let not the operator be in too great a haste to take the film out of the developer and hold it up to the light for examination. Let it remain in the tray untouched until the shadows of the picture, that is to say the cream-coloured patches of the negative, grow darker and darker; until, in fact, these patches are scarcely distinguishable in tone from those parts which darkened first.

When the darkest portions of the negative appear, by transmitted light, to be absolutely

black and opaque, and when the main features of the picture can be distinctly seen upon the back of the film, the process of development may be considered to have been carried far enough. It will generally be found that when using the Frenöl solution the process of developing a normally exposed film has occupied fully ten minutes or a quarter of an hour.

The exact moment when development should be stopped is always difficult to determine. Fortunately there is considerable latitude, as it is only in extreme cases of underdevelopment that it will prove quite impossible to obtain a print of some kind from the negative.

It may be observed, in this connection, that the intensity of a landscape negative should be greater than that of a portrait, and the development hence be carried further in the former than in the latter case. The result of overdevelopment in the case of a portrait is that the high lights are clogged, and, giving hard and chalky prints, lose all the finer gradations of flesh modelling.

The point at which the process of development should be suspended thus varies greatly with different exposures, being largely dependent upon the character

of the subject. Objects which naturally present but little contrast of light and shade should, as a general rule, receive a comparatively short exposure and a protracted development. On the other hand, subjects with brilliant high lights and very dark shadows should have these contrasts reduced by a comparatively long exposure and a rapid development. An accurate judgment in these matters can only be obtained by experience and close observation of the effects produced in the finished picture.

As a guide to the beginner we may briefly characterize the effects of insufficient and of excessive development.

UNDERDEVELOPMENT results in very thin and weak negatives, the highest lights of which are not sufficiently opaque to prevent, during the subsequent process of printing, the sensitized paper from darkening beneath them.

If the exposure of the film in the camera has been of just about the right duration, and the negative underdeveloped, many of the details in the shadows of the finished picture will be altogether lacking. If, on the other hand, the exposure in the camera has been somewhat too long, and the negative underdeveloped, all the details of the picture will be visible, but lacking in contrast. In the latter case the defect may be

remedied, in some degree, by submitting the negative to the after process of *intensification*, full directions for which are given in all photographic text books.

OVERDEVELOPMENT results in excessively black and opaque negatives, which may require days to print.

If the exposure of the film in the camera has been somewhat too short, and the negative overdeveloped, the details will be lacking from the high lights of the finished picture, and the print will be harsh and staring. If the exposure in the camera has been approximately correct, the printing quality of the negative may be greatly improved by submitting it to the after process of *reduction*, directions for which will be found in the text books.

It may be remarked that beginners are much more prone to underdevelop than to overdevelop their negatives, and it is well to bear in mind that, of the two extremes, underdevelopment is by far the worse.

The same developing solution may be used for two or three films in succession. Its action will, however, gradually become slower and less vigorous, and it is not advisable to carry this economy too far. The value of the chemicals employed is insignificant, an ounce of fresh Frenol developing bath, sufficient for

several lantern sized films, can be made up at a cost of but one-eighth of a penny.

Let the Frenographer be warned against developing several films in one tray at the same time. This is a favourite time-saving device, but it is attended with grave dangers, not only on account of the greatly increased liability of the delicate gelatine surfaces to be injured during the inspection of the films, but also, and more particularly, on account of the tendency of the films to float together and adhere in the liquid, and to develop unevenly in consequence.

RINSING.

When development is complete, the film should be placed in another tray and washed by pouring clean water over it, so that all traces of the developing solution are removed from its surface. When this has been done, the film may be exposed to daylight without harm.

FIXING.

The film should then be transferred to the fixing bath. This should be made up in advance, as a stock solution, and should consist of

**One part of Hyposulphite of Soda,
dissolved in five parts of water.**

Or in other words, one cupful of hypo crystals to five cupfuls of water. This solution will keep any length of time.

Take enough of it, in a good-sized tray, to completely submerge the negative, which must be left therein for some minutes after every trace of the white colour has disappeared from the back of the film. No harm will be done by allowing the negative to remain in the fixing solution for ten minutes or a quarter of an hour.

Always make the fixing bath of uniform strength. One pound of hypo will make just half a gallon of stock solution. Do not be tempted to add alum, or any other chemical, to the hypo bath. Do not use the bath after it has become charged with silver through fixing many films, and has become discoloured, or begins to work slowly. Hypo is cheap, and such economy is short sighted, as it may risk the permanency of many a valuable negative.

HARDENING.

When, as is liable to occur in warm weather, the gelatine coating of the film shows a tendency to frill or blister during the process of development, it should, after fixing, be placed for two or three minutes in a saturated solution of common alum.

This hardening bath may be used repeatedly, until it becomes discoloured. It may be easily prepared by putting an ounce or two of powdered alum in a half-pint bottle, filling up with water, and shaking. The undissolved alum which settles at the bottom of the bottle need not be disturbed in pouring out the dose.

WASHING.

When the batch of films developed at one operation have been thoroughly fixed and rinsed, they must be placed in a large vessel and washed for two or three hours, in running water, or in frequent changes. It is recommended that the film should be held, during the process of washing, in the rack and tank supplied for this purpose.

When a number of films are allowed to swim about in one vessel, especially when they have not been previously subjected to the hardening action of an alum bath, there will be much danger of the tender gelatine surface becoming scratched and abraded. Upon this point Colonel Waterhouse, Surveyor-General of India, has remarked, "I find that these films require more careful treatment than one is disposed to give them, in view of their being so much more easily handled than glass, and not so liable to break. No one would think of washing a lot of dry

plates on glass together in a tub, though it seems natural and harmless enough to do so with these light films, which are more like prints than negatives. The tender gelatine coating of the films is, however, just as liable to be injured by the sharp corners of the celluloid, as it would be by glass. The films ought, therefore to be washed separately, and with quite as much care as glass plates."— *Year Book of Photography*, 1892.

This is, perhaps, an extreme view. The danger of injuring the gelatine surface will be greatly diminished if the alum bath is used immediately after fixing. When the surface has been thus hardened, and when the stream of water flowing into the washing vessel is not so rapid as to cause a great commotion amongst the films, no bad results will be likely to ensue. All danger, will, however, be obviated by the use of the washing rack.

The permanency of the negative will depend in large measure upon the thoroughness of this process of washing. Any vestiges of hypo permitted to remain in the film will tend to discolour and to destroy the silver image.

DRYING.

When the films have been sufficiently washed they should be removed from the water and allowed to drain and to dry spontaneously.

They should be placed, gelatine side uppermost, upon some flat and inclined support,—preferably upon the drying-board supplied for this purpose. The gelatine surface must on no account be permitted to come into contact with the support. Let the operator assure himself most carefully that the films are laid upon their smoother and more shiny celluloid side.

Permit the films to remain undisturbed until they are perfectly dry. This will ordinarily require some ten or fifteen hours. Artificial heat must never be employed to accelerate the process of drying; placing the films near the fire would be very likely to melt or crack the gelatine and destroy the image.

VARNISHING.

Valuable negatives, which are likely to be often printed, should be varnished as soon as they are perfectly dry. It is quite as important to thus protect films, as glass dry plates, from the accidents of abrasion in handling, from the destructive effects of moisture, and from that form of silver staining which is liable to occur at any time from the use of damp printing papers.

The ordinary photographic varnishes, prepared for glass plates and containing methylated spirit, must not, however, be used for films, as they have a tendency to dissolve and discolour the celluloid support, thus ruining the negative. In so far as we are aware the Frena Film Varnish is the only preparation specially designed and adapted for use with the films.

Pour into a deep tray, which has been scrupulously cleaned, the contents of the bottle supplied. Take a thoroughly dry negative and run an ordinary pin about half-way through one of the lobes of the notched sides, near the corner of the film. Lifting the film by the head of the pin, entirely submerge it in the varnish. As soon as the liquid has flowed evenly over every part of the negative, draw it out edgewise and hold it in a vertical position for a moment, permitting the excess of varnish to drip back into the tray from the corner opposite the pin. Still holding the film by the head of the pin, and being careful not to touch the surface of the negative with the fingers, pin it securely upon some upright support, such as the cross-bar of a window sash, in such wise that the back

of the film does not come into contact therewith. In about half an hour the varnish will be dry, and the negative effectively protected by a tough, smooth, and altogether impermeable coating.

The film varnish may be used over and over again. When it becomes dirty it should be filtered through a tuft of cotton placed in a small glass funnel.

Section 13.

DEVELOPMENT AS A CRITERION OF EXPOSURE.

It is a fascinating magic, and an ever-recurring delight, this gradual appearance of the negative image upon the blank white surface of the film. But, entirely apart from the charm of the operation, the process of development has an instructive value which must not be overlooked. The Frenographer will find that one of the greatest advantages of developing his own negatives will be the possibility of obtaining thereby a trustworthy guidance in respect to the duration of his exposures.

When an amateur receives a batch of finished negatives which have been developed for him by some professional photographer he may, indeed, be told why it is that so and so many of the exposures would not make satisfactory pictures. But knowledge obtained by this royal road does not tend to impress

itself upon the mind. Many of the original shortcomings will, moreover, have been concealed by the innumerable devices of the craftsman, and will thus altogether fail to convey a lesson to their author. Hence the development of every picture, ought, if possible, to be undertaken by the one who has made the exposure.

The indications which may be derived from an attentive observation of the behaviour of the film in the developing solution will conclusively prove whether, in setting the speed of his shutter, the operator has come within the limits of correct exposure, or, if he has erred, whether this has been upon the side of under or of overexposure.

When the amount of light admitted through the lens to the sensitive surface has been sufficient, yet not excessive, the dark patches which form the negative image will appear rather slowly, and in a regular gradation: the high lights of the picture first, the details in the shadows last. If, on the other hand, the entire film, though not fogged through extraneous light, rapidly darkens all over when placed in the developer, this may be taken as an evidence that the exposure has been too long. If the high lights alone appear, and continue to become very black and opaque before the details are visible in the deepest shadows, this will be a proof that the exposure has been too short.

In the case of every film, the Frenographer should endeavour to recall to his mind the conditions under which the exposure was made,—chiefly reverting to the actinic efficiency of the light at the time (compare page 54), but not omitting to take into consideration the colours of the natural objects (page 55), and their position in relation to the sun (page 47). It is thus alone that a trustworthy judgment can be acquired in regard to the requisite length of photographic exposures.

The extremes of error may be thus briefly characterized.

OVEREXPOSURE.

The negative “flashes out,” that is to say, darkens all over soon after being placed in the developer. The gradation of tone in the image is insufficient; the contours undefined. In short there is a general lack of contrast. If the development be suspended before the shadows of the finished picture are clogged through the undue precipitation of silver upon them, the high lights will be found to remain too feeble and transparent. A print made from an overexposed negative will be wanting in brilliancy, and, in a certain sense, in definition.

The operator who has become somewhat experienced in photographic manipulation will find that overexposure may be in a measure counteracted during development by the addition of a small quantity of Bromide of Potassium to the developing solution. Let an ounce or so of this restrainer be made up in a dropping bottle, the proportions being one part of Bromide of Potassium to 10 parts of water. This will keep, and may be regarded as a stock solution.

When the behaviour of a film in the normal developer indicates overexposure, let 4 to 8 drops of the restrainer be added as soon as possible to each ounce of the developing solution. The development may then be carried somewhat further as regards density of the image than is ordinarily necessary.

When the contrasts of colour are naturally weak in the subject depicted, as will be the case with architectural details photographed under a dull sky, or with certain landscapes, a small quantity of the restrainer may be advantageously added to the developer, even when the exposure has been of normal duration.

When Bromide of Potassium has been added to a developer this bath should, of course, not be employed for the development of another film, unless this is known to be likewise overexposed.

UNDEREXPOSURE.

When the film is placed in the developing bath, the high lights of the picture will appear

rather slowly, and will continue to acquire density, while the shadows remain a blank. An underexposed and fully developed negative will give a *heurté* print, with inky shadows and hard and staring high lights.

There is no effective remedy for underexposure. Where the light has had no chemical action, the developer labours in vain to precipitate a silver image. To increase the proportion of Frenol in the developing solution would only tend to heighten the contrasts in the negative. The course which will produce the best results possible under such untoward conditions, is to dilute the customary Frenol developer with an equal quantity of water. In this weak bath the negative may develop slowly for an hour or more.

The operator should bear in mind that Frenol differs from all other chemicals used for development, inasmuch as it requires to be diluted, rather than strengthened, for cases of underexposure.

Section 14.

PRINTING ON CHLORIDE PAPER.

THE processes of photographic printing are many, and the results which may thereby be attained differ greatly in appearance. Yet all these processes are based upon one and the same principle : that of exposing to light, beneath the finished negative, a surface which has been rendered sensitive to actinic rays. Those portions of the negative which are dark coloured and opaque, shield the sensitive surface from the chemical action of these rays during the operation of printing, and thus form the lighter portions of the finished picture. The shadows correspond to the more transparent parts of the film. In this way the *negative* image, in reversed chiaroscuro, serves to engender a *positive*, the lights and shades of which correspond to those of the scene photographed.

The method of printing, which we are about to describe, is technically known as the Gelatino-Chloride of Silver process. It has the advantage of producing results superior both in beauty and in permanence to those of the Albuminate of Silver process (which it is rapidly supplanting). Moreover it is, with the sole exception of the inferior blue-print, or Ferro-Prussiate process, the simplest of all methods of positive making.

Gelatino-Chloride paper is prepared by various manufacturers. It is supplied ready for use, and has comparatively good keeping qualities.

The image formed upon it is visible during the process of printing, and it is thus possible, by examining the positive from time to time, to suspend the operation when the correct depth of tone has been obtained. The after processes of toning and fixing may be performed in one bath, in broad daylight and without preliminary washing. The surface of the finished prints may be rendered either matt, or highly glazed.

PRINTING.

The requisites herefor are: the sensitized paper, one or more printing frames, and, if it be desired to make prints having white margins, a selection of paper masks.

The sensitized paper may be purchased either in large sheets, which may be cut up with scissors as

required, or in packages of separate leaves, ready cut to the size most suitable for pictures made with the Frena No. 1, namely $3\frac{1}{8}$ by $3\frac{3}{8}$ inches.

The chloride of silver coating of the printing paper is far less sensitive to light than is the bromide of silver emulsion of the films, and hence does not imperatively require the protection of a photographic dark room. The sensitized sheets should not, however, be exposed, during the process of cutting up, or of filling the frames, to the strong daylight which is required for printing. It is advisable to expeditiously unpack and manipulate the paper in the dark corners of an ordinary room, or behind a screen or curtain. The degree in which such exposure to light is permissible can readily be gauged. The sensitized surface must never be allowed to darken to a perceptible extent before being placed in contact with the negative, inasmuch as such discoloration would impair the brilliancy of the high lights in the finished picture.

Packages of gelatino-chloride paper should be efficiently protected from dampness, the effects of which are detrimental to the keeping qualities of all sensitized photographic materials.

The printing frame is a holder containing a sheet of glass, against which the negative and the sheet of sensitized paper are pressed in close contact by means of a spring pressure-board. This pressure-board is so hinged as to permit of the print being examined,

during exposure, without disturbing the relative positions of film and paper.

Masks are sheets of opaque paper, somewhat larger than the print, having central apertures of various sizes and shapes, through which the desired portions of the negative can be printed. The margins of a print thus masked, being protected by the opaque paper, remain white.

The process of printing is extremely simple. Remove the spring pressure-board from the glass of the printing frame, place the negative, shiny celluloid side downwards, upon the glass. On the face of the negative lay a sheet of sensitized paper, with its glossy side towards the film. If a print with white margins be desired, insert a mask having an aperture of suitable size between the negative and the sensitized paper. Replace and fasten the spring pressure-board, so as to hold the sheets in close contact.

The printing frame, with its contents, must then be exposed, glass uppermost, to bright daylight.

It may be observed that the stronger the light in which the process of printing is carried out, the less marked will the contrasts become in the finished picture. If

the negative is very dense and black, with strongly pronounced contrasts of light and shade, it may be advantageously printed in direct sunlight. If, on the other hand, the negative is thin and delicate, it should be printed slowly, at some distance from the window. The influence of the light in thus affecting the contrasts of the negative is, however, not very marked; it can never make up for the defects of extreme under or overdevelopment.

The length of time required for printing varies enormously, in accordance with the actinic efficiency of the light, and, more particularly, with the density of the negative. A somewhat underdeveloped film, with clear shadows, may be sufficiently printed, on a bright day, in five or ten minutes; while an overexposed and overdeveloped negative may require to be placed in the direct sunlight for a full day. The photographer will do well to make a rough estimate of the density of the film from which he is about to print, and to examine the progress of the operation some little while before he thinks it probable that the sensitized paper will have become sufficiently dark.

This examination may be made, in subdued

light, by folding back the hinged pressure-board of the printing frame, and lifting up the sensitized paper from the film, care being taken that the relative positions of the negative and the print are not altered. If the print be not sufficiently dark the pressure board can be again folded down upon it, and the exposure continued.

Let the inspection be as rapid as is consistent with an accurate judgment of the depth of tone which has been acquired. Do not be tempted to gaze at the print for the sake of its pictorial interest. The longer the frame remains open the greater the liability of the whites of the picture to be degraded through extraneous light. And the oftener the frame is opened the greater the danger of the paper being shifted upon the film, and the image thus becoming blurred.

Before being taken from the frame, the print must be allowed to become somewhat darker than the finished picture is to appear, inasmuch as the process of fixing appreciably diminishes its depth of tone.

It is difficult to describe the exact degree of excess which has thus to be allowed for, but it may be roughly estimated to be equivalent to 15 per cent. of

the total exposure. In other words, if the sensitized paper is found, on examination, to have acquired, after an exposure of say one hour, just that degree of depth which is desired in the finished picture, the print should be permitted to remain in the frame, under identical conditions of light, for another ten minutes or so. A little experience will soon give the operator an instinctive judgment in respect to the depth of tone which is thus required as an excess.

When the picture is sufficiently dark, the pressure board should be removed from the glass and the print taken out of the frame. It may then be at once subjected to the action of a chemical bath, which prevents further darkening of the image by removing the chloride of silver not affected by light, and at the same time charges its unsightly brick red colour to an agreeable dark chestnut.

It is not necessary to fix and tone the sheets of sensitized paper as soon as they are printed. If put away in a light-tight box, or wrapped in several thicknesses of brown paper, the prints will remain unaltered for many days, and can be toned at convenience.

FIXING AND TONING.

We recommend the beginner to make use of a combined fixing and toning bath.

The advantages of this are that the prints do not require a preliminary washing, and can hence be fixed and toned, one by one, in broad daylight, as soon as they are taken from the printing frame. A combined fixing and toning bath is the simplest and most expeditious means of performing these operations, and its results are fully equal to those obtainable by the more complicated methods. The formula which we give is substantially identical with that published by the Eastman Company in connection with their chloride paper.

Make up the following two stock solutions, which will keep, separately, any length of time.

STOCK SOLUTION No. 1.

Hyposulphite of Soda	...	1 pound.
Common Alum (Potash Alum, not Soda Alum)	...	3 ounces.
Sulphate of Soda (Glauber's Salt)	... ..	9 ounces.
Water	... ..	5 pints.

These quantities are calculated to fill a large "Winchester" bottle. The slight turbidity of the solution will not interfere with the action of the toning bath; still it is well to let this stock solution stand for two or three hours before using.

STOCK SOLUTION No. 2.

Chloride of Gold ...	...	15 grains.
Acetate of Lead (Sugar of		
Lead) ...	...	64 grains.
Water ...	...	8 ounces.

Chloride of gold is sold in hermetically sealed glass tubes, each containing exactly 15 grains. Place one of these tubes in a half-pint bottle, and break it by a blow with a stirring rod. There will thus be no chance of waste. A heavy precipitate will settle in this stock solution, which must be well shaken up before being added to the toning bath.

To make the TONING BATH, take of:

Stock Solution, No. 1	...	5 ounces.
Stock Solution, No. 2	...	$\frac{1}{2}$ ounce.

The precipitate in the solution No. 2 will be completely dissolved on being poured into the stock solution No. 1. The quantity given will efficiently tone 30 or 35 prints of the size of those required for the pictures made with the Frena No. 1. It is, however, not advisable to let the bath stand more than a day or two after having been mixed, as an old toning bath has a tendency to give yellowish tints to the half tones of the print.

Entirely submerge the print in the solution thus prepared, taking care, if several sheets be toned at once, that they do not float together and adhere, as uneven toning would result. The process of fixing will be rapid, the print losing its excessive depth of tone almost immediately, and becoming of a lighter brick red. Permit the print to remain in the bath until this colour has become altered to the tone desired.

The change of tint will take place in the following sequence : Light brick red, reddish chestnut, chestnut brown, greyish brown, yellowish black. It is not advisable to continue the toning process after a rich dark chestnut colour has been obtained. The greyish brown and yellowish black tints are not pleasing, as they give to the print a sallow and faded appearance. The length of time required for toning will be about five or ten minutes, according to the darkness of the prints, and the freshness and temperature of the toning bath. Prints tone more rapidly in warm than in cold weather.

WASHING.

When the print has been sufficiently toned it should be removed from the toning bath and washed for 2 or 3 hours in a large vessel

of clean water;—under a tap, if possible; if not, in frequent changes. The permanence of the print will depend almost entirely upon the thoroughness of this washing.

Various forms of print washing tanks have been devised, and undoubtedly do much towards expediting the process. The most essential requirements of such apparatus are that the prints should be kept in constant motion by the stream of inflowing water, and that the outflow should be taken from the bottom of the vessel, so as to carry away all traces of the chemicals which are washed out from the prints. A prolonged soaking is far less effective than a comparatively short rinsing in flowing water.

DRYING.

After the print has been thoroughly washed it should be carefully taken out of the water, and laid face upwards upon any plain surface to dry spontaneously. On no account should the print be dried between blotting papers, as the gelatine side would adhere thereto.

If a highly glazed surface be desired, the print may, on being taken from the washing water, be placed face downwards on a polished slab provided for this purpose, and gently pressed into close contact by

means of a rubber squeegee. No air bubbles should remain between the face of the print and the slab. In the place of the slab a sheet of plate-glass or a ferrotype plate may be used, provided the surfaces of these substitutes be rubbed, before the wet print is laid upon them, with a solution consisting of a piece of spermaceti about as large as a hazelnut dissolved in a 4 ounce bottle of benzine. Exact proportions are not essential. If the glass or ferrotype plate has been touched with a few drops of this solution, and gently polished with a soft cloth, the print may be readily stripped therefrom.

If a matt surface be desired, a piece of ground glass, treated with the spermaceti solution as described, should be substituted for the polished plate.

The print must not be stripped from either of these supports until it has become thoroughly dry.

MOUNTING.

Gelatino-chloride prints which have not been glazed may be mounted with pure paste or mucilage in the usual manner.

In the case of enamelled or matt surface prints, special precautions are requisite in order to preserve the surface in its full perfection. The mount should have a preliminary coating of tragacanth or dextrine mucilage, and be permitted to become dry. Meanwhile the back of the print, when nearly dry, and

before being stripped from the support, should be brushed over with very thin pure glue, well filtered. When the print with its backing of glue has become thoroughly dry, it should be removed from its support and placed upon the mount which has been moistened by passing a damp sponge over it. This is rather a troublesome process, and it may be questioned whether it is worth while to enamel those prints which are to be mounted.



Index.

	PAGE		PAGE
ABNEY, cited	7	Charging with Films...	27, 87, 89,
Actinic Value of Light	54-57		103-111
Æsthetic Rules	44	Check	24, 84, 85, 102
Albuminate-of-Silver Printing		Chemical Action of Developer	121
Process	145	Chemical Image	54, 121
Alum Bath	133, 134	Chemicals for Development...	125
Amateur Work, Characteristics		Children, Pictures of	38
of	40	Chloride of Gold in Tubes ...	152
Angle of Illumination	47	Choice of View	33-45
Angle of Movement ...	39, 58, 60	Cleanliness of Developing	
Animals, Movement of	60	Dishes	126
Aperture of Lens	32, 54	Clearness of Sky	48
Aperture of Shutter	67	Collodion Process	5
Apparatus for Development...	125	Colorado, Clearness of Atmos-	
April, Exposures in	52	phere.....	49
Architectural Views, Perspec-		Color of Print.....	150, 153
tive of	77-78	Colors, Actinic Value of ...	42, 55
August, Exposures in	52	Composition of Picture	34
BACKING CARD (<i>see</i> Card.)		Contrasts of Negatives... ..	130, 142
Blue Print Process.....	145	Cord Sealing Frena	20
Blue Spectacles.....	43	Cost of Developing Bath.....	131
Breathing during Exposure ...	73	Cover Plate	20, 70
Bromide of Potassium Solu-		Cyclists	60
tion	142	DARK ROOM	91
Brothers, cited.....	7	Dark Room Illumination..	91, 123
Burton, quoted	6, 37	Dark Room, Testing Light of	123
CARD	30, 96, 97, 110	Darkening of Film in Deve-	
Carriage Speed	59	loper	128
Carroll's Law.....	16	Deferred Development	122
Celluloid Support.....	95	Deferred Toning	150
Celluloid Side of Film	105	Definition of Lens	75, 81, 82
Changing Film	24, 83-85	Density of Negative ...	127-131
		Derivation of name Frena	16

	PAGE		PAGE
Developing Dishes.....	128	Fixing Films	132, 133
Development	121, 136	Fixing, Principle of	121
Development a criterion of		Fixing Prints.....	150—153
Exposure	139, 141	Focal Length of Lens	32, 58
Development, progress of 127—130		Fogged Negatives	140
Dilution of Developer	143	Foliage, Colour of	44
Dimensions of Frena	32	Foliage on Windy Days	41
Displacement of Image	58	Foreground, Character of	36
Distant Views	49	Formulas for Development ...	124
Distortion of Image.....	77—78	Fractions of Second on Time-	
Drunken Architectures	78	Plate	66
Dry-Plate Process	6	Freight Train	59
Drying Film Negatives 135, 136		Frenol Developer	125
Drying Prints	154, 155	Frenol Formula	127
Dummy Film 28, 29, 101, 102, 109			
Duration of Exposure.....	50—62	GELATINE SIDE OF FILM 104, 105	
Duration of Time Exposures 118		Gelatino - Chloride Printing	
Duration of Development.....	129	Process	145
Duration of Printing.....	147, 148	Gioppi, cited	7
		Glazed Surface of Prints 154, 155	
EDER, cited	7	Green, variable Actinic Value of	55
Egypt, Light in	57	Grouping of Picture.....	34
Elevation of Standpoint.....	36	Groups	40
Enamelling Prints	154, 155		
Envelopes for Films.....	94	HALATION	97
Estimation of Actinic Values 55, 56		Handle	24, 76, 83
Etymological Note	16	Hardening	133
Examination of Developing		Harrow, Views from.....	49
Negative	128, 129	Haze in Atmosphere	49, 57
Examination of Print	149	Hepworth, quoted	7, 50
Excess of Tone in Printing		Holder	27—29, 100, 101, 106
.....	149—150	Holding the Frena, 61, 62, 70—75	
Express Train	59	Horizon in Picture	43
		Horizontality of Camera... 77—82	
FACIAL EXPRESSIONS.....	60	Horse in Movement	59
February, Exposures in	52		
Ferro-Prussiate Printing Pro-		ICELAND, LIGHT IN.....	57
cess	145	Incidence of Light	47
Filling Holder	106—110	Indicator	25, 86—89
Film Changing Mechanism		Intensification	131
.....	99—103	Intensity of Illumination	55
Film Varnish	137	Illumination of Subject,	
Films	95—99	41, 46—49, 119	
Filtering Film Varnish	138	Improvised Dark Room	91
Finder	22, 33	Inclination of Camera, 77—79, 117	
Finger Marks on Films	93	Interiors	119, 120
Fixing, Duration of Process... 133		Interiors, Exposures in ...	52, 120

	PAGE		PAGE
JONES, cited	6	Permanency of Negative	135
June, Exposures in	51	Permanency of Prints	154
July, Exposures in	51	Perspective, Correctness of, 77—82	
KENTUCKIAN, quoted	98	Pizzighelli, cited	7
Klari, cited	7	Point of View	34—40
LANDSCAPE NEGATIVES,		Pointers	101
Density of	129	Portraits	40
Landscapes, Exposures for	52	Portraits, Exposure for	52
Latent Image	121	Portrait Negatives, density of, 129	
Length of Exposure 50—62, 118		Position of Frena during dis-	
Level	76, 78, 80	charge	24, 85
Liesegang, cited	7	Positive Image	122
Light, Actinic Value of ... 54—57		Positives, Photographic	144
Light in Printing	147, 148	Posting Films	94, 112, 113
Literature of Photography ... 6, 7		Preservation of Films	98, 99
Manuals of Photography	6, 7	Pressure-board	27, 106
Manufacturers of Films ... 97, 98		Printing Frames	146
March, Exposures in	52	Printing Processes	144—145
Marine Views, Exposure for ... 51		RACERS	60
Masks for Printing	147	Rapidity of Frena Films	54
Matt Surface of Prints	155	Reading Indicator	86, 87
May, Exposures in	51	Reduction	131
Methods of Development	124	Reflected Light	48
Monochromatism	42	Register Spring	24, 77, 83
Movement of Camera	61, 62	Relative Sizes of Figures	38
Movement of Object	57—61	Removing Films	26, 90—95
Mounting Prints ... 155, 156		Restrainer	142
Murky Skies	57	Reversal of Films	105
NEGATIVE IMAGE	122	Revolution of Handle,	
Notching of Film Edges, 96, 102		24, 25, 83—85	
Number of Films in Frena, 31, 107		Revolution of Holder	103
OCTOBER, EXPOSURES IN	52	Rinsing Films	132
Order of Operations	25, 65	Roscoe's Estimate of Actinic	
Outline of Operations	17—31	Value	57
Overdevelopment	131	Running Figures	59
Overexposure, Indications of,		SAILING VESSELS	60
141, 142		Schmidt, cited	7
PAPER for Wrapping up Films, 94		Scope of Picture	34
Packing Films ... 94, 95, 112, 113		Sensitized Paper	145, 146
Packing the Frena	114	Sensitized Surface of Films	
Packs of Films	95, 104	104, 105	
Parallel Lines	77—82	Separate Films	108
		September, Exposures in	52
		Septum	103
		Setting Indicator	87—89, 109

	PAGE		PAGE
Setting Shutter for Time Ex-		Thunderstorm Clears Air	49
posures	115, 116	Tilt of Camera	77-79, 117
Setting Shutter Speed	65, 68	Time-catch	64, 65
Sharpness of Image	58	Time-catch Aperture.....	66, 68
Shutter	21, 23, 63-69	Time Exposures... 68, 69, 115-119	
Shutter Knob	21, 63, 64	Time Exposures, Setting	
Shutter, Principle of	66	Shutter for	68
Shutter Set-off	23, 70	Time Rod	68, 69, 116
Shutter Set-off, Releasing 71, 74		Tint Values	42
Sky-Line	43	Toning Formula.....	151, 152
Soaking Films	126	Toning Prints	150-153
Solar Spectrum, Photograph of 55		Toning Process, Duration of... 153	
Sorting-Teeth	101	Train, Photographing from ... 62	
Southern England, Light in ... 57		Turning Handle ... 24, 25, 83-85	
Speed of Shutter	65-68		
Spermaceti Solution	155	Underdevelopment.....	130
Spring Check, <i>see</i> Check.		Underexposure, Indications	
Spring of Shutter.....	67	of	142, 143
Standard of Actinic Efficiency 56		Ultraviolet Rays	56
Steadiness of Frena during			
Exposure.....	71-75	Vacancy of Foregrounds.....	36
Steamboats	59, 60	Vapour in Atmosphere	49
Stock of Films in Frena	103	Variability of Shutter Aperture 67	
Straining of Lens	81, 82	Varnishing Film Negatives	
Strap-handle	26, 111	136-138	
Street Scenes	60	Vehicles, Photographing from 62	
Street Scenes, Exposure for ... 52		Vertical Lines	77-82
Sunrise and Sunset Light	56	Vibration of Machinery	62
Sun Shining into Lens	48	Vidal, cited	7
Suspension of Development... 129		Vieuille, cited	7
Supporting the Frena	73, 117	View Finder (<i>see</i> Finder).	
Swing Back, Use of.....	76-82	View Meter.....	35
Symmetrical Illumination	47	Vogel, cited	7
TABLE OF CONTENTS	12	WALKING FIGURES.....	59
Table of Exposures	51-52	Washing Films	134, 135
Table of Light	47	Washing Prints	153, 154
Table of Movements	59	Water Supply in Dark Room 124	
Tanks for Print Washings ... 154		Waterhouse, quoted	134, 135
Technical Data	32	Weight of Frena	32
Temperature of Developing		Wet-Plate Process	5
Water	124	Winding Shutter	21, 63-65
Test Glass for Colour	43	Windows, Photographing..... 119	
Testing Changing Mechanism		Winter Months, Exposure in... 52	
99-103		Wrapping-up Films	94, 95
Thickness of Film.....	95		

Frena Price List.

**The Frena No. 1—**

£ s. d.

Complete with 40 films ready for use 5 5 0

Solid Leather Case to carry Frena, with
Sling Strap 0 13 6Waterproof Canvas Case to carry Frena,
with Sling Strap 0 7 6

Sling Strap only to carry Frena .. 0 1 6

Frena Films, per packet of 20 .. 0 2 6Developing 40 films and supplying 1
mounted print of each 1 0 0

Developing 20 films 0 5 0

Printing and mounting 20 prints .. 0 5 0

Printing 20 prints unmounted 0 4 0

Envelopes for sending Frena negatives
by post, in sets of 3, per doz. sets .. 0 1 6Enlargement 12 × 12 from Frena nega-
tive, mounted 0 5 0

L

Albums for Frena Prints—

Pocket Albums to hold 36	..	..	0	0	6
Album to hold 2 on page, 40 pages stiff					
card	..	..	2/6	&	0 4 6
Album to hold 4 on page, 60 pages stiff					
card	..	..	5/0	&	0 7 6

**Developing Sets. DEVELOPING AND
PRINTING APPARATUS.**

No. 1. Complete Developing Set comprising the requisite apparatus, and sufficient materials for making about 500 negatives as follows :—

Dark Room Lamp.

1 Large Porcelain Dish.

1 Small „ „

3 „ Xylonite Dishes.

Washing Rack and Tank.

3 Glass Measures.

Dropping Bottle.

1 Large Bottle Frenöl.

1 „ „ Hypo.

1 „ „ Alum.

1 Small Bottle Potassium Bromide.

Supply of Alum & Hypo in Crystals.

In Mahogany Cabinet 4 0 0

Developing Sets—Continued.

No. 2. Compact Developing Set for travelling, containing sufficient materials for developing about 100 negatives as follows :—

Dark Room Lamp.

1 Small Porcelain Dish.

3 Xylonite Dishes.

Washing Rack and Tank.

2 Glass Measures.

1 Dropping Bottle.

Bottle of Frenöl.

Supply of Hypo & Alum in Crystals.

In Mahogany Cabinet 2 0 0

No. 3. Cheaper Developing Set to develop 100 negatives 0 15 0

Developing Apparatus—

TRAYS. Xylonite, transparent, with retaining flap for developing	0	1	0
„ Xylonite, opaque, for hardening, rinsing, &c...	0	0	6
„ Porcelain, for developing or hardening	0	0	6
„ Glass do. do. ..	0	0	7
Porcelain, large, for fixing toning or washing	0	1	7

Developing Apparatus—Continued.

Rack and tank for washing negatives ..	0	7	6
Drying-board	0	5	0
Spare clips for drying negatives, per doz.	0	0	6
Glass measures, 10 oz. capacity ..	0	1	6
„ 4 oz. „ ..	0	1	0
„ 2 oz. „ ..	0	0	8
„ 1 oz. „ ..	0	0	7
„ 1 dram „ ..	0	0	6
Camel's Hair brushes, flat, 2 in. wide..	0	0	8
Dropping bottle, 1 oz.	0	0	6

Developing Chemicals—

Frenol developer, 3 oz. bottle	0	1	6
Hyposulphite of Soda per lb.	0	0	2
Alum „	0	0	6
Bromide of Potassium per oz.	0	0	3
Frena Negative Film Varnish, per bottle	0	1	0

Printing Apparatus—

Printing Set, containing the Apparatus and sufficient Chemicals for making 144 Frenographs, as follows :—

6 Printing Frames.			
1 box of Masks.			
3 large Porcelain Dishes.			
Plate for Glazing Prints.			
144 pieces of Sensitized Paper, cut to size.			
100 Mounts.			
Toning and Fixing Solution,			
ready for use.	1	0	0

Printing Apparatus—Continued.

Bynoe Printing Frame	0	1	0
Do do. Nickel-plated ..	0	1	6
Masks per box	0	1	0
Slab for Drying and Glazing Prints ..	0	3	6

Gelatino Chloride Sensitized Paper—

Ilford Paper, in sheets, 22 × 17, 2 sheets	0	1	4
Eastman's, cut to size .. 48 pieces	0	1	0

Mounts—

Plain White or Cream, rounded corners,			
per 100	0	1	0
Coloured, with gilt bevelled edges ..	0	4	0
India Tints, platesunk mounts	0	10	0

Solutions—

Toning & Fixing Solution, 16 oz. bot. 1/0	0	2	6
Gold Solution 2 oz. bot. 1/6			
Mounting Solution per bot.	0	1	0

London:
Printed by Barclay & Fry,
63, Queen Street, E.C.